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U.S. Patent 6,148,065

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6,148,065

U.S. Patent Number 6,148,065
Inventor: Ronald A. Katz
Issue Date: November 14, 2000

All claims of U.S. Patent No. 6,148,065 are invalid in light of the following prior art:

- Moosemiller, John. P. "AT&T's CONVERSANT I Voice System." *Speech Technology* – Mar./Apr. 1986 pp. 88-93;
- U.S. Patent No. 4,755,872 ("Bestler *et al.*");
- U.S. Patent No 4,656,624 ("Collins *et al.*"); and
- Steven C. Grant and Yvonne Brooks Grant, *The Teleconnect Guide to Automatic Call Distributors*, 2d Ed. January 1985, ("The Teleconnect Guide").

Accompanying this submission, please find one or more claim charts applying one or more of the above cited prior art references being applied to one or more claims from U.S. Patent No. 6,148,065.

Accompanying this submission, please find a copy of *Ronald A. Katz v. AT&T Corp.*, 63 F.Supp.2d 583 (E.D. Pa. 1999), in which that court construed some elements of patent claims issued to Ronald A. Katz and a copy of *Marlow Indus., Inc. v. Igloo Prod. Corp.*, No. 02-1386, 2003 WL 21212626, (Fed. Cir. May 23, 2003)(unpublished).

Pursuant to 37 U.S.C. §1.555, "each individual associated with the patent owner in a **reexamination** proceeding has a duty of candor and good faith in dealing with the [Patent] Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability in a reexamination proceeding" (*See* 37 U.S.C. §1.555 and MPEP 2280)(emphasis added). "Informing the examiner of the pending infringement action is not commensurate with bringing to the examiner's attention the districts court's prior claim construction of the patent or disclosing the court orders embodying this construction. *See Rohm & Haas Co. v. Crystal Chem. Co.,* 722 F.2d 1556, 1572-73, 220 USPQ 289, 302 (Fed. Cir. 1983) (concluding that a presumption that an examiner was able to find, with his expertise and adequate time, the critical data when he was presented with a **"mountain of largely irrelevant data"** ignores the real world conditions under which examiners work)." *Marlow Indus., Inc. v. Igloo Prod. Corp.*, No. 02-1386, 2003 WL 21212626, at *2-3 (Fed. Cir. May 23, 2003)(unpublished)(*See Fed. Cir. Rule 47.6*)(emphasis added).

Pursuant to 37 U.S.C. §1.555, we believe that the prior art, decisions, opinions, orders, and arguments associated with the following proceedings may be pertinent:

- *West Interactive Corp. v. First Data Resources Inc.*, 1991 WL 355059 (D. Neb. July 22, 1991);
- *First Data Resources Inc. v. West Interactive Corp.*, No. 91-CV-4471 (C.D. Cal. August 20, 1991);
- *West Interactive Corp. v. First Data Resources Inc.*, 972 F.2d 1295 (Fed. Cir. 1992);
- *Ronald A. Katz Tech. Licensing, LP v. AT&T, Corp.*, No. 97-CV-539 (D. Neb. Oct. 27, 1997);
- *Ronald A. Katz Tech. Licensing, LP v. AT&T, Corp.*, No. 98-CV-88 (D. Neb. Mar. 2, 1998);
- *Ronald A. Katz Tech. Licensing, LP v. AT&T Corp.*, 63 F.Supp.2d 583 (E.D. Pa. 1999);
- *Ronald A. Katz Tech. Licensing, LP v. Micro Voice Applications Inc.*, No. 99-CV-592 (N.D. Cal. Feb. 8, 1999);
- *Enhanced Global Convergence Serv., Inc. v. Ronald A. Katz Tech. Licensing, LP*, No. 01-CV-375 (D. N.H. Oct. 5, 2001);
- *Verizon Cal., Inc. v. Ronald A. Katz Tech. Licensing, LP*, No. 01-CV-9871 (C.D. Cal. Nov. 16, 2001);
- *Enhanced Global Convergence Serv., Inc. v. Ronald A. Katz Tech. Licensing, LP*, No. 02-CV-66 (D. N.H. Feb. 2, 2002);
- *Ronald A. Katz Tech. Licensing, LP v. Verizon Communications Inc.*, 2002 WL 1565483 (E.D. Pa. July 16, 2002);
- *Ronald A. Katz Tech. Licensing, LP v. Verizon Communications Inc.*, 2002 WL 31834833 (E.D. Pa. Dec. 18, 2002); and
- *Ronald A. Katz Tech. Licensing, LP v. Verizon Cal., Inc.*, No. 03-CV-1918 (C.D. Cal. Mar. 18, 2003).

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Claim 1, 2, 5 U.S. Patent No. 6,148,065

Claim Elements	**The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT I Voice System."** ***Speech Technology*** **– Mar./Apr. 1986 pp. 88-93.**	**The Prior Art – Bestler et al. U.S. Pat. No. 4,755,872 filed Jul. 29, 1985, issued Jul. 5, 1988**
A system to be utilized with a **telephone facility** for on-line handling of **customer data** contained in a memory in accordance with a select operating format comprising:	"In September 1985, AT&T Conversant Systems introduced the CONVERSANT I Voice System, a voice response and speech recognition product for the growing market of automated information services." (p. 88). This system accesses data bases via the public telephone network. (p. 88). Moosemiller discloses a system in which customer data is handled on-line: "For example, a catalog service user may log in with tone or speech recognition, download accumulated orders from a hand-held terminal to a system modem, and leave a voice message for a supervisor via the real-time voice coder…" (p. 89).	Bestler discloses an Impulse Pay Per View System and Method, the Zenith PHONEVISION system. "As shown, the system comprises a plurality of telephone communication units (TCUs) 20 each located at a corresponding telephone company central office 22." (Col. 5, Lines 51-54). Bestler discloses a method for automatically billing customers who order the event: "It then authorizes the home terminal units in accordance with the IPPV requests by transmitting the subscriber's cable address and a new authorization code in the vertical blanking interval, generates the commercial transaction, and downloads the transaction to a billing system." (Abstract).
means for receiving called terminal digital data **(DNIS)** signals automatically provided by said telephone facility to identify said select operating format from a plurality of distinct operating formats	The CONVERSANT system has the ability to receive DNIS signals from the communication facility. DNIS can then be used by the processor to classify the incoming call for different applications: "The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol. This allows advance classification of incoming calls for different applications which are greeted by appropriate transaction prompts. The DNIS feature is	Bestler discloses a system in which the called number dialed by the caller is used to determine what cable event the cable subscriber wishes to purchase: "Illustratively, the next two digits represented by VV (dialed by the customer) identify the event or cable television program which the cable subscriber wishes to purchase." (Col. 4, Lines 32-34).

Material claim element terms are in **bold**. Corresponding prior art disclosure is underlined.

and for **receiving caller telephone number data** from said telephone facility;	useful for service bureaus or for multiple-user applications." (p. 88).	Bestler discloses the interface structure as capable of receiving ANI data from the communication facility. "Each of several central offices in a metropolitan area will provide ANI information representing the cable subscriber's phone number and a code representing the cable event to be viewed or cancelled. The data is sent asynchronously to a respective telephone communication unit located at the central office. This telephone communication unit (TCU) does some buffering, eliminates unnecessary data, and sends data synchronously to a telephone communication controller (TCC) located at the cable headend station." (Abstract).
an **operator terminal** for use by a person to communicate through the telephone facility;	Moosemiller discloses an operator terminal. On p. 89 depicted in Fig. 1 is a system terminal and system printer as outputs for use by a live operator attendant. Further, "The system is capable of out-dialing, bridging to an attendant for help..." (p. 89).	
interface switching means connected to said receiving means and said **operator terminal for receiving incoming calls;**	The System Controller on p. 89 and the Trunk interfaces are capable of receiving incoming calls. "The trunk interface answers an incoming call and communicates this to the system controller via the GPIB." (p. 88). Fig. 1 (See p. 89) depicts the overall hardware of the Conversant system. Shown are operator terminals interfaced with the system controller.	

	System Controller is capable of bridging calls received from the trunk interface to attendants.	
computer means coupled to said interface switching means for **connecting an incoming call by a caller to said operator terminal** based on a condition,	Moosemiller discloses the ability to route a call to an operator. "The system is capable of… bridging to an attendant for help, or completing a partially automated transaction." (p. 89).	
said **caller telephone number data being stored** in said memory such that said computer means	The CONVERSANT system is able to complete outward calls, from a list of telephone numbers stored in memory. An article by Perdue, entitled "CONVERSANT 1 Voice System: Architecture and Applications" and published in Sept. / Oct. 1986 demonstrates a system where the caller telephone number is stored in a data base: "Other customers are using the call system's generation capability to call credit card holders with account irregularities. The system obtains a list of particular card holder phone numbers from a host computer and automatically places the calls." (Perdue, p. 45).	
in accordance with said select operating format is **capable of accessing said customer data on a selected customer which has a telephone number** corresponding to said caller telephone number data	"The progress of each call is monitored. When a call is answered, it is immediately transferred to an idle attendant and a message is sent to the host computer, which displays the person's account information on the attendant's video screen." (Perdue, p. 45).	Bestler discloses how ANI data can be used to access customer data on a select customer. Bestler uses the ANI number to access a converter code, and to check validity of a subscriber. "In the event that system control 46 cannot map the telephone number into a converter code (because, for

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automatically provided from said telephone facility,		example, of a wrongfully dialed telephone number), an error is generated at 158. That error can also be generated if the data base reflects the unavailability of the event for purchase by that particular subscriber, because of bad credit, tardy bill payments, or whatever reasons are considered to be adequate by the cable company." (Col. 15, Lines 9-17).
said computer means **visually displaying said customer data** on a selected customer and said operator terminal capable of providing data entries to said memory; and	As described above, Perdue discloses the ability to visually display customer data on a monitor: "When a call is answered, it is immediately transferred to an idle attendant and a message is sent to the host computer, which displays the person's account information on the attendant's video screen." (Perdue, p. 45).	
said customer data on a selected customer contained in memory **is updated by incorporating said data entries into said customer data.**	Perdue in disclosing outward call management shows how operators can use "the call system's generation capability to call credit card holders with account irregularities." (Perdue, p. 45). As the operator terminal contains keyboard, and access to data bases, and is used for updating customer account irregularities, it is assumed that the operator is able to update each caller's file as necessary.	Bestler discloses updating billing data based on customer number data. "System controller 46 also downloads the necessary information to billing computer 50 so that the cable subscriber will be billed for the IPPV event." (Col. 16, Lines 41-44).

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Dependent Claims	
Claim 2	**The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT I Voice System."** ***Speech Technology*** **– Mar./Apr. 1986 pp. 88-93.**
A system to be utilized with a telephone facility according to claim 1, further comprising: **voice generator structure** **coupled to said interface switching means for prompting callers** to enter digital data.	Claim 1 is invalid in light of the prior art as discussed above. Moosemiller discloses a Voice Switch controlling many Voice Response Units (See Fig. 1, p. 89). "The trunk interface answers an incoming call and communicates this to the system control via the GPIB. Transaction software determines what greeting phrase to play. This is followed by a prompt to dial "1" for tone input; the voice response unit is attached, if not already dedicated, and commanded to play the phrases and collect touch-tone signals." (p. 88)

Claim 5	**The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT Voice System."** ***Speech Technology*** **– Mar./Apr. 1986 pp. 88-93**
A system to be utilized with a telephone facility according to claim 1, **wherein said operator terminal provides data entries relating to said caller.**	As discussed above, claim 1 is obvious in light of the prior art. As seen in Fig. 1 (p. 89), a system terminal is disclosed that can access disks and host interface lines via system controller. Thus, the system terminal allows operators to enter data relating to a caller. As Moosemiller describes, "the system is capable of outdialing, bridging to an attendant for help, or completing a partially automated transaction." (p. 89).

Claim 13: U.S. Patent No. 6,148,065

Claim Elements	The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT I Voice System." *Speech Technology* – Mar./Apr. 1986 pp. 88-93	The Prior Art – Collins et al., U.S. Patent No 4,656,624 filed May 3, 1985, issued April 7, 1987
A system to be utilized with a **telephone facility**	"In September 1985, AT&T Conversant Systems introduced the CONVERSANT I Voice System, a voice response and speech recognition product for the growing market of automated information services." (p. 88).	Collins discloses in Fig. 1 an illustrative telecommunication system.
for on-line handling of customer **data contained in a memory**	As can be seen in Fig. 1 (p. 89), the system controller has access to disks which store customer data. As described above, the system "accesses data bases via the public telephone network." (p. 88).	"Process control block 460, within process block 450, contains a process number 462, discussed above, used to identify the process. The process control block also contains the identification of the incoming trunk or line number 464; the associated operator position number 466; the number of any linked processes 468 (such as a process for controlling communications with remote data base 150); and a call type indicator 478. In addition, the process block contains general data about the call, such as billing data 480 and switching network data 482 which describes the call configuration." (Col. 11, Lines 8-19).
in accordance with a **select operating format** comprising:	The Conversant system is able to support a wide variety of applications. Examples given include: Financial Services Credit Authorization Wholesale and retail distribution Sales order entry Direct Marketing Transportation scheduling and dispatching College Registration Communication Services (p. 88).	

Material claim element terms are in **bold**. Corresponding prior art disclosure is underlined.

means for receiving called terminal digital data (**DNIS**) signals automatically provided by the telephone facility to **identify the select operating format** from a plurality of distinct operating formats;	"The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol." (p. 88). "This allows advance classification of incoming calls for different applications which are greeted by appropriate transaction prompts. The DNIS feature is useful for service bureaus or for multiple-user applications." (p. 88).	
an **operator terminal** for use by a person to communicate through the telephone facility;	As can be seen in Fig. 1 (p. 89), there exists a system terminal with system printer connected to system controller. Further, "the system is capable of out-dialing, bridging to an attendant for help, or completing a partially automated transaction."(p. 89).	Collins discloses a variety of Agent / Operator Positions. Agent Position 211 Operator Position 110 Operator Position 111 Operator Position 160 Operator Position 161 Agent Position 1160 Agent Position 1161 Agent Position 1110 Agent Position 1111 "Details of the operator position are illustrated in typical operator position 160 of operator assistance system 1. As shown hereinafter in Fig. 8, an exemplary agent position is similar." (Col. 6, Lines 23-26). Notably, the operator has both B-channel for voice communication, and D-channel for data communication. The operator has Terminal processor 201 which generates signals to control voice controller 206, and display 202 for generating visual outputs, and keyboard 203. (See Col. 6, Lines 26-68).

interface switching means	Trunk Interface and Voice Switch	Circuit Switching Network 154 Packet Switching Network 155 Collins discloses the use of a circuit switching network and/or a packet switching network to interface operators with remote callers. "Circuit switching network 154 may be any well known digital telecommunication circuit switching network." (Col. 3, Lines 60-62).
connected to the receiving means	"Most common analog trunk types and T1 digital carriers can be serviced through the system's telephone network interfaces. The system can dial out on lines and two way trunks, and it can work in conjunction with Automatic Call Distributor and Private Branch Exchange systems." (p. 88).	"Also shown are outgoing lines or trunks 180, ..., 181 connected to ports 180A, ... , 181A on circuit switching network 154 of operator assistance system 1; outgoing trunks are also connected to other switching systems. The ports are an interface between the switching network and connected transmission units such as customer lines, trunks to other offices, multiplexed transmission facilities, and data interfaces to data communication systems and to control processors." (Col. 4, Lines 5-14).
and the operator terminal for receiving incoming calls; and	As can be seen in Fig. 1, a system terminal is coupled to the Trunk Interface via System Controller and General Purpose Interface Bus (GPIB). Such a configuration allows the system to be capable of "bridging to an attendant for help, or completing a partially automated transaction." (p. 89).	"Circuit switching network 154 of operator assistance system 1 is also connected to a group of operator positions 160, 161..." (Col. 3, Lines 66-68).
processing means connected to the interface switching means	Moosemiller discloses the transaction state machine which is able to process data entered by a caller.	Processor 151

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for **receiving** customer number data entered by a caller and	"Other instructions collect the user's speech or touch-tone signals." (p. 91).	"When the customer has finished dialing and processor 151 has detected the operator position request." (Col. 8, Lines 64-66).
for storing the customer number data in a **memory** and	"This system accesses data bases via the public telephone network." (p. 88).	This data must necessarily be stored in memory if the call is to be completed.
based on a condition **coupling an incoming call to the operator terminal,**	The system is capable of "bridging to an attendant for help, or completing a partially automated transaction." (p. 89).	"When the operator at operator position 160 is initially connected to a customer, an initial display control message from processor 151, sent via packet switching network 155 to the operator position, sets up the operator position display 202." (Col. 8, Lines 7-11).
the processing means **visually displaying the customer number data,**	As can be seen in Fig. 1, the system terminal has a video screen capable of displaying caller data. In an article by Robert J. Perdue entitled "CONVERSANT 1 Voice System: Architecture and Applications," published in Sept. 1986, the operator terminal's functionality for the Conversant System is described in greater detail: "When a call is answered, it is immediately transferred to an idle attendant and a message is sent to the host computer, which displays the person's account information on the attendant's video screen." (Perdue, p. 47).	"The visual output informs the operator of the major details of the call so that the operator may interact verbally with the customer and receive additional information." (Col. 8, Lines 13-16).
the operator terminal providing **other data entries to the memory to update data relating to the caller.**	The operator system terminal interfaces with the System Controller, thus allowing it to access disks. As Perdue describes, this configuration allows operators to use "call system's generation capability to call credit card holders with account irregularities." (Perdue, p. 45).	Processor 151 may alter the configuration of the call (for example, by letting a person-to-person call complete to its destination) or may record information about the call (such as the calling card number of the calling customer) on the basis of the data keyed into the operator position by the operator." (Col. 8, Lines 21-26).

[redacted]

AT&T's CONVERSANT™ I Voice System

This new voice response system, with its many telephone trunk interfaces, is targeted for the growing market of automated information services uses.

John P. Moosemiller
Member of Technical Staff
AT&T Bell Laboratories
Columbus, OH

IN SEPTEMBER 1985, AT&T Conversant Systems introduced the CONVERSANT™ I Voice System, a voice response and speech recognition product for the growing market of automated information services. This system accesses data bases via the public telephone network. Telephones, rotary or touch-tone, can become instant terminals eliminating the need for costly computer peripherals and providing easy availability.

The CONVERSANT I has many speech capabilities. Callers access the system through touch-tone signals, speaking isolated words and connected digit strings, or by using modems and data terminal equipment. The system responds with high-quality, natural-sounding speech using an advanced speech coding algorithm developed by AT&T.

CONVERSANT I applications include the following broad areas of information dissemination:

- financial services
- credit authorization
- wholesale and retail distribution
- sales order entry
- direct marketing
- transportation scheduling and dispatching
- college registration
- communication services

Hardware Architecture

The hardware architecture for the CONVERSANT I is flexible, expandable, and modular. It allows one to economically configure just the necessary voice channel capabilities. Additionally, the system controller and the voice switch can allocate speech processing units as needed, thus time-sharing them. For example, a catalog service user may log in with tone or speech recognition, download accumulated orders from a hand-held terminal to a system modem, leave a voice message for a supervisor via the real-time voice coder, and finally dial an attendant dispatcher, all within one use. It can be packaged from four to 80 channels.

The controller (Fig. 1) executes system software under the UNIX™ operating environment. Through this, local control of transactions is accomplished, along with substantial off-loading of host processing. Winchester disks provide ample storage for local data bases, coded speech, and system software. For reliability, these disks may be duplicated. Multiple data communication ports provide common data link protocols, including IBM 3270 BSC and SNA, and asynchronous ASCII TTY. The system controller communicates to intelligent and relatively autonomous speech subsystems via the IEEE 488 General Purpose Interface Bus (GPIB).

An internal voice switch supports the bridging of speech units to each incoming voice channel. One-to-many connections are possible. Four-wire continuity is preserved, permitting speech units to separately modify the signal gain for incoming and outgoing voice channels. The voice switch (Fig. 1) is the key to real-time allocation of speech processing hardware, which occurs under direction of the system controller via the GPIB. Simple system configurations, however, can make the voice switch unnecessary. For example, Fig. 1 shows voice response units directly connected to incoming trunk channels. Any speech processing units may be optionally bridged to incoming calls via the voice switch.

Most voice response systems only provide line interfaces to the telephone network, whereas the CONVERSANT I system adds many common trunk interfaces. Call supervision, the immediate knowledge of call progress and termination, is important for effective management of telecommunication costs and is possible only with trunks. The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol. This allows advance classification of incoming calls for different applications which are greeted by appropriate transaction prompts. The DNIS feature is useful for service bureaus or for multiple-user applications.

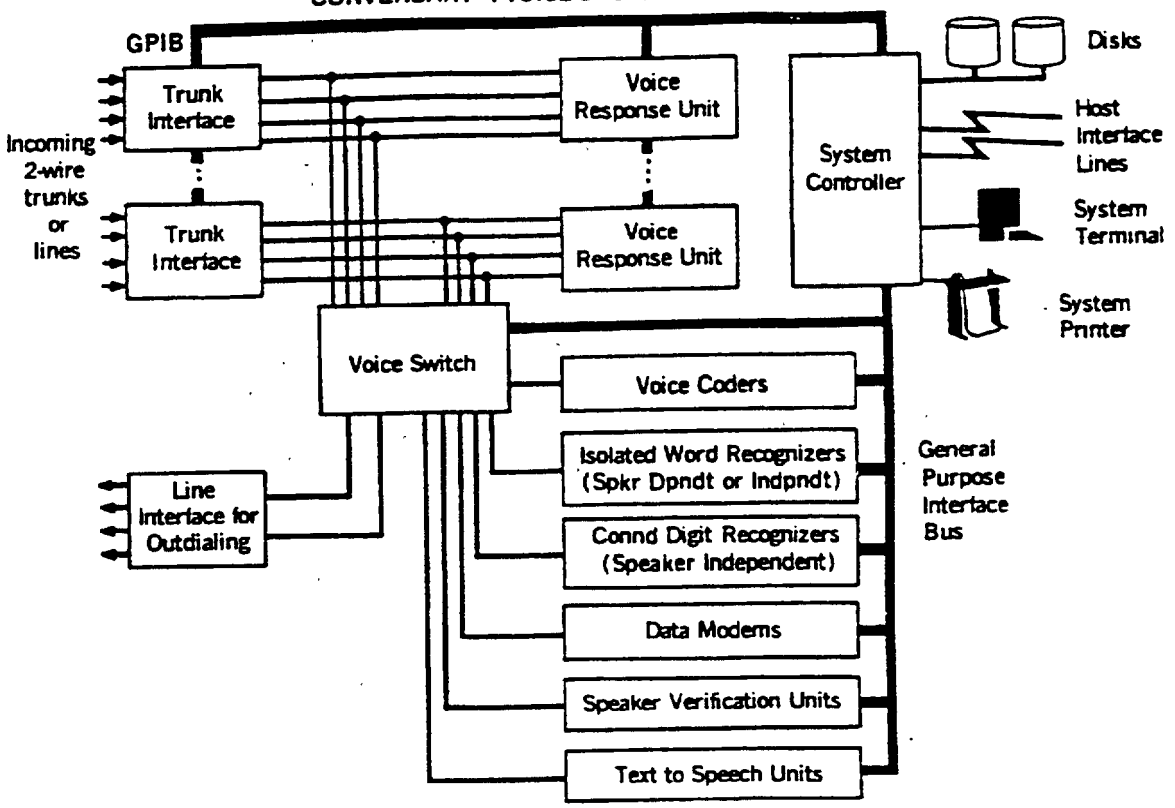
Most common analog trunk types and T1 digital carriers can be serviced through the system's telephone network interfaces. The system can dial out on lines and two-way trunks, and it can work in conjunction with Automatic Call Distributor and Private Branch Exchange systems. With direct trunk connections, though, the cost of the latter approach may be unnecessary.

The hardware architecture also allows for control of the speech subsystems and all subunits, including the switch and the network interfaces. This is done by the system controller using the GPIB. The following example illustrates this.

The trunk interface answers an incoming call and communicates this to the system controller via the GPIB. Transaction software determines what greeting phrase to play. This is followed by a prompt to dial "1" for tone input, the voice response unit is attached if not already dedicated, and commanded to play the phrases and collect touch-tone signals. If no tones are heard, the unit signals the controller over

Fig. 1

CONVERSANT™I VOICE SYSTEM ARCHITECTURE



the GPIB and it dictates the switch to bridge on a speech recognizer. The transaction continues to use the voice response unit to generate prompts and the speech recognizer to accept the user's voice commands. Transaction control and the speech subsystems management are performed by the system controller through the GPIB.

Design and Features

With the CONVERSANT I's flexible architecture, new features and channel capacity can be added as requirements change. It can operate standing alone or as a front-end processor to one or more host computers. The basic product uses touch-tone signaling and voice response. The internal voice switch bridges optional speech processing subsystems under direction of the system controller. Depending on the system's configuration, it can service up to 80 simultaneous calls and run different types of transactions concurrently.

Both telephone line and trunk interfaces are available, the latter providing direct call progress and supervision as part of the protocol exchanged with a central switching office. The system is capable of outdialing, bridging to an attendant for help or completing a partially automated transaction. In addition, CONVERSANT I's real-time voice coder allows customers to record daily messages and make minor response changes conveniently on site. The system can also support voice mail.

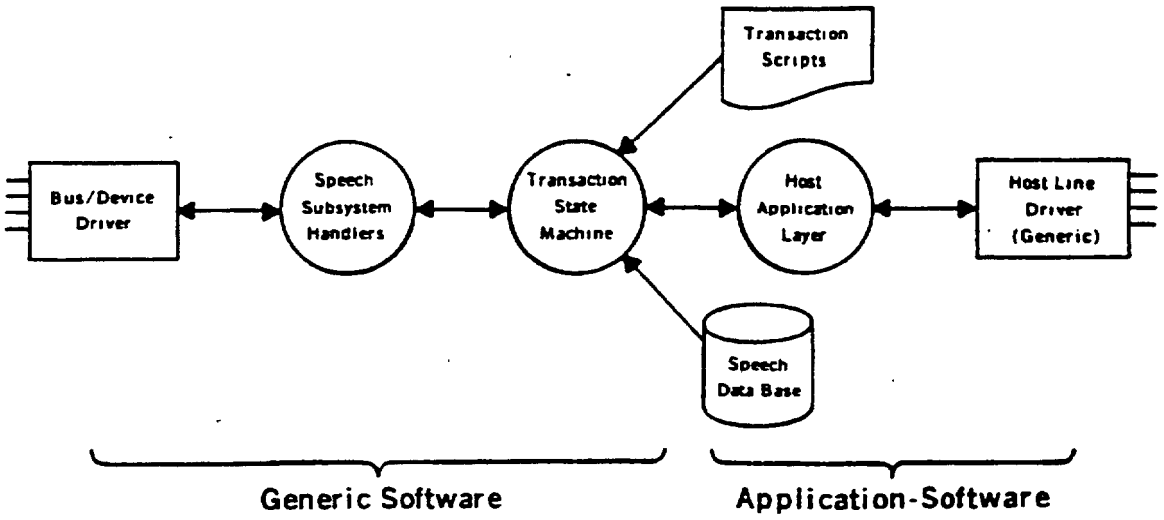
Voice recognition can be added to the basic product. Speaker independent and dependent recognition are available with both isolated and connected word capabilities. Automated services can be provided to rotary telephone users through speaker independent recognition of connected digit strings.

Features for reliability include backup disks, power supplies, and streaming tape drive. The system has built-in self diagnosis and will automatically reboot and recover if a severe operating problem is detected. Complete administrative and maintenance software tools are accessed through the system console or remote control.

When compared with traditional means of providing information services, the CONVERSANT I system is very cost effective. It reduces attendant costs through automation and provides revenue through new services that were previously uneco-

Fig. 2

CONVERSANT™I SOFTWARE ARCHITECTURE



nomical

Speech Processing Technologies

Three speech technologies—speech synthesis, recognition, and coding—are embodied in the CONVERSANT I. High quality speech playback is accomplished efficiently using Multi-Pulse Linear Predictive Coding (MPLPC) algorithms developed at AT&T Bell Laboratories [1]. Good intelligibility is preserved at 9.6K bps, a rate compatible with the system's real-time voice coder. Studio quality occurs at rates approaching 14K bps. Each voice response unit has the capacity to store 400 seconds of MPLPC speech and virtually unlimited amounts of speech may be downloaded in real time from system disk storage. We have found that voice playback quality strongly influences users' perception of a service's worth. For this reason, our efforts have concentrated on synthesis by analysis of recorded speech, rather than synthesis by rule from text alone.

Both speaker independent and dependent speech recognition are possible, and isolated and connected utterances can be recognized. For speaker independent recognition, the vocabulary is currently limited to connected digit strings, isolated digits, and the words "yes" and "no." Robust recognition of telephone speech by the general public requires a substantial voice sampling effort [2].

Speech recognition is accomplished through statistical template matching with Dynamic Time Warping (DTW). AT&T Bell Laboratories has researched these algorithms for some time [3]. In addition, acoustic phonetic algorithms enhance the decision process and identify words within connected speech. Since the transmission bandwidth of telephone networks is only about 3.3 kHz, telephone speech is first sampled at a frequency of 6.67 kHz. Front-end processing of the speech signal involves an 8-pole auto-correlation analysis which results in an efficient representation called Linear Predictive Coding (LPC). Recognition occurs by comparing LPC coefficients for the speaker's utterance—called the test template—with LPC coded words in the data base—the reference templates. Within thresholds, the unknown word is assumed to belong to the same class as the set of templates it most closely matches using Itakura's distance metric [4].

For many applications, such as voice mail, daily announcements, and feedback of speaker-dependent command words, it is desirable to provide real-time voice coding. The CONVERSANT I satisfies this need with a voice coder that converts an analog speech signal into 9.6K bps MPLPC in real-time. The converted speech may be stored in digital format on the system disk and played back through the voice response unit immediately or later.

Future Speech Technologies

Two other related technologies, speaker verification and text-to-speech synthesis, are under investigation. The first is an automatic means of confirming the identity of a claimant based on historical speech patterns. This capability exists as a working prototype. Second, text-to-speech, or rule-based synthesis from text, is necessary for applications with open-ended vocabularies, such as proper names and addresses. AT&T Conversant Systems is monitoring research that promises to advance text-to-speech performance, such as efforts to devise better pronunciation rules for foreign words in an English context. When significant improvements in text-to-speech are possible, AT&T Conversant Systems will incorporate them in the CONVERSANT I product. In the mean-

time, they will consider integrating other commercial text-to-speech units.

Application Software

Application software development may be done by AT&T Conversant Systems, a value-added reseller of the product, or the user. To facilitate development, clear delineations have been made between generic operational software and application software. In what follows, software architecture will be discussed in three areas: 1) applications development, 2) high-level script language used to define transactions, and 3) AT&T's experience in prototyping applications

■ Development

A simplified view of the CONVERSANT 1's software architecture emphasizing the customizable parts for applications, is shown in Fig. 2. Central to the architecture is the transaction state machine (TSM) which, through a single process, controls all active sessions. Although the TSM is generic, it interprets transaction scripts. Many different scripts may reside in the system and be executed concurrently. Which script to run is determined by the telephone number that was dialed, the physical telephone circuit on which the call was received, or further interaction with the user (scripts can transfer control to other scripts). The TSM controls all speech subsystems through various handlers and drivers. The applications programmer does not have to know how these devices work; they exist only as logical entities implied by the functionality of the script language.

The application programmer is responsible for the host application layer. Interactive communication with an external host computer is typical, but not absolutely necessary since the application may access a local data base on the system disk. Either way, some modules must be developed to process the content of data messages supporting the application. It is possible to place all information in the transaction script when prototyping applications. Currently, the host application layer must be written as C language subroutines. The developer, however, does not have to be concerned about lower-protocol layers because they are handled by generic host drivers.

Although not strictly software, the speech data base, which prompts the end user or verbalizes retrieved information through the voice response units, must be considered part of the application. The transaction script language has built-in knowledge of how to access the speech data base and is acted upon by the TSM.

■ Transaction Script Language

AT&T Conversant Systems has developed a high-level language for defining transaction scripts, thus making it easy to prototype speech applications and maintain them. The script language lets the application developer treat the TSM as a virtual machine. Device control details are hidden and automatically managed.

Instructions in the TSM script language were designed specifically for voice transactions. They include voice response instructions that speak phrases, numbers, and characters—in sensible ways with flexible intonation. Other instructions collect the user's speech or touch-tone signals or mediate data base transactions with a remote host computer. The following example illustrates logging into a service by voice entry of a numeric ID

```
SCRIPT INSTRUCTION                    COMMENTS/ANNOTATION
MAIN.
  tfile ("/talk/script1")             /*talk phrase xref file */
  LOGON ( )                           /*call LOGON subroutine */
  SERVICE ( )
  BYE ( )
LOGON:
  talk ("hello, welcome")             /*say greeting phrase */
  talk ("please speak id")            /*prompt for verbal input */
  getdig (DIG9, ch.LOGID,9)           /*collect 9-digit response */
  dbase (0, VERIF, ch.RESP,
    RESPLEN, ch.LOGID, LOGLEN)        /*verify host 0 data base */
  jmp (r.0 < im.0 no reply)           /*timeout on host? jump */
  talk ("account verified for")
  tchars (ch RESP)                    /*confirmation string */
  rts ( )                             /*subroutine return */
SERVICE.
  rts ( )                             /*details not shown */
NO REPLY
  talk ("sorry, service is unavailable, try later")
BYE.
  talk ("thank you for calling")
  quit ( )
```

The flexible architecture of the CONVERSANT 1 system makes instructions for allocating devices appropriate. For example, a speech recognizer may bridge on only if the caller does not have a tone signaling telephone. Additional instructions for flow control and data manipulation provide a complete programming environment.

Using the high-level TSM script language, we have repeatedly implemented complex transaction sessions in a few pages of textual instructions. It has also been shown that transaction software written in the C language can be converted to script format with a resultant compression factor of 10 or more. Mnemonics are employed throughout scripts to reference encoded speech files, data structures, and subroutine labels. Because of these factors, the transaction script language is an effective tool for application developers and a

readable and maintainable definition of the application.

■ Prototyping

AT&T Conversant Systems has developed applications by first prototyping them. This is done by quickly generating a transaction script that simulates the initial concept, complete with dialog, but with little or no host application layer. By prototyping, the customer receives early exposure to the target transaction. It provides an easy way of retrying the simulation until it is substantially correct. The applications AT&T Conversant Systems has prototyped include: stock quotations, catalog ordering, airline reservations, dial-it information menus, caller destination control, and telephone banking.

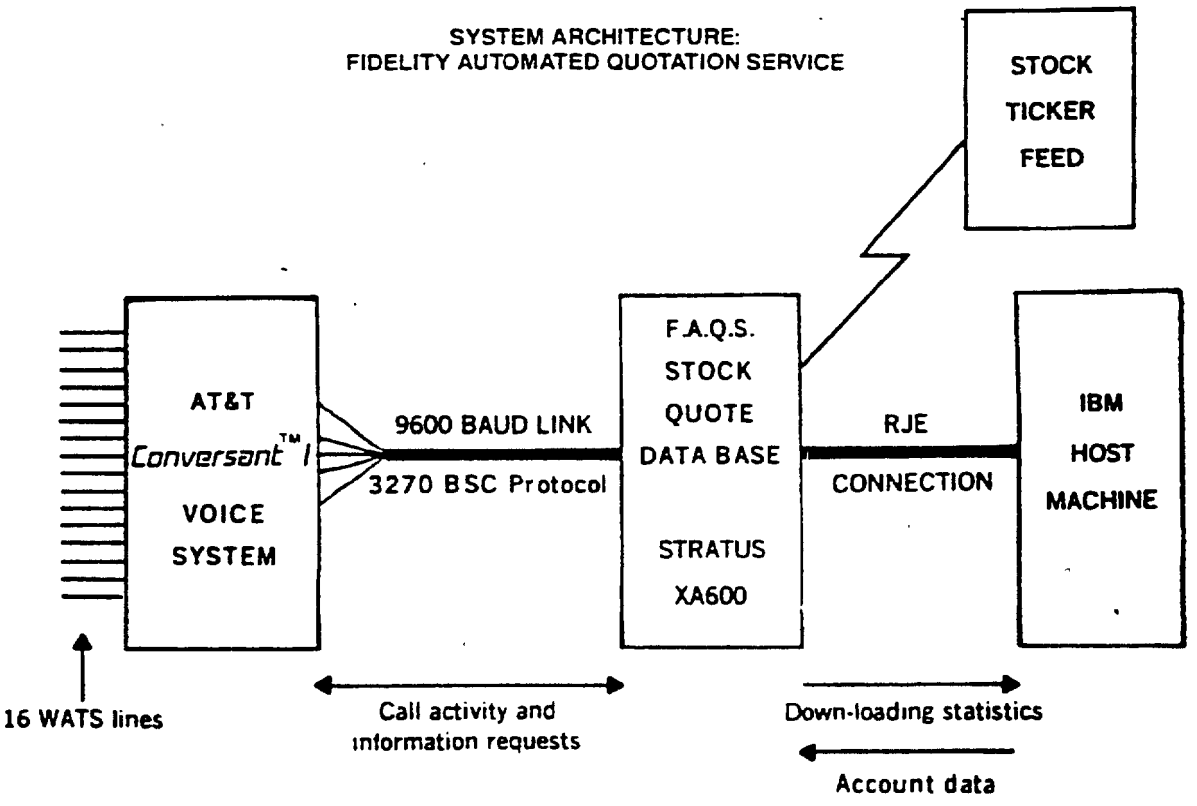
Several considerations go into prototyping and application development. Most important, though, is the user model. Successful implementation of the application depends upon three factors:

- easy access and utility
- adequacy and necessity of information provided
- minimal connect time

The last attribute is important to the service provider because it reduces telecommunication costs. It is also significant to the end users who weigh their time against alternative sources of information. In assessing application success, one must bear in mind the end user's short-term memory capacity and how information processing restraints affected it. For instance, input prompts should state or strongly imply the valid responses, such as "yes" or "no," at the end of the message. Retrieved data, such as numbers that must be spoken as a series of individual words, may be unintelligible if attention is not given to prosody (rhythm) and intonation. Poor intelligibility increases the information processing load on the user and reduces attention to the main task. The transaction script language aids prototype development by providing built-in intonation and pronunciation rules for numeric and character strings.

Once the application concept is defined, a familiar series of steps result in functional data requirements, flow diagrams, and transaction dialog. Prototyping gives the developer early feedback on human factors of a voice transaction without having to fully implement data base interfaces and error handling.

Fig. 3



Stock Quotation Application

One application in use is AT&T Conversant Systems support of a stock quotation service for customers of Fidelity Brokerage Services, a major discount brokerage house in Boston. This represents the first commercial application of connected speech recognition in support of automated delivery of information services by telephone.

In this application, the CONVERSANT I is a front-end processor to the service provider's quotation data base and a host computer with customer account information, as shown in Fig. 3. The service provides on-demand quotations for 6000 stocks, stock option quotations, a personal stock watch list for convenience, and the current Dow Jones Industrials Average. Transaction control is provided locally in the CONVERSANT I, that is, it determines how many quotes to provide per call and when to provide help messages. Only a few, carefully defined messages need be exchanged with the data base machine to support the application, and they are strictly informational messages. They accomplish the following:

- LOG—validates user ID number, returns stock watch list
- DOW—returns Dow plus time and date
- STK—accepts stock number, then outputs ticker symbol, and quote
- OPQ—accepts option number with its month and strike price codes, outputs option quote
- OFF—logs off confirmation for each user session
- STA—uploads accumulated system transaction statistics

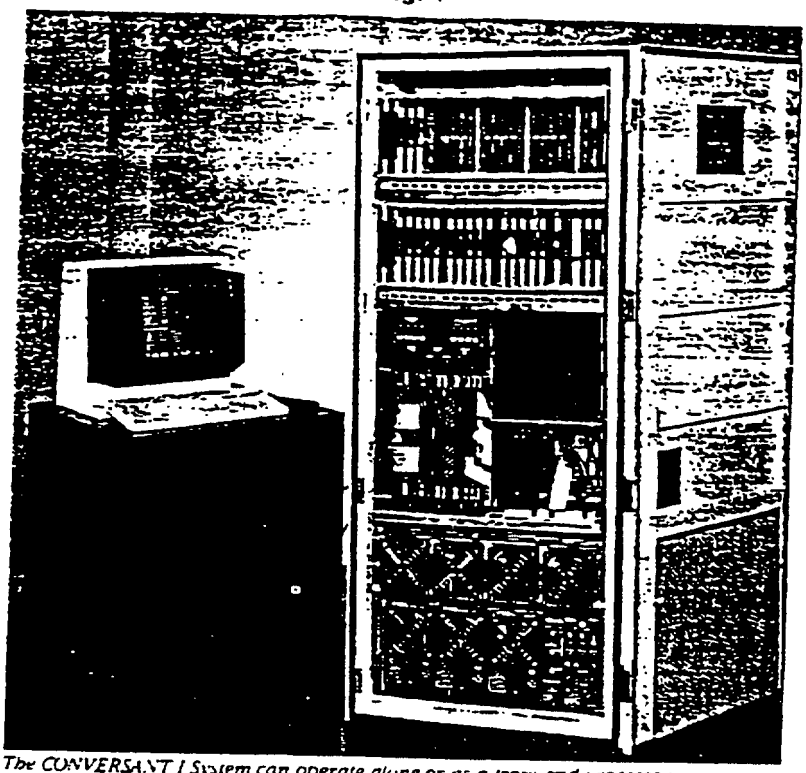
By offloading transaction control, the data base host can perform more effectively. The host also supports a personal computer service separate from this application. A multi-threaded data stream arrangement allows only a few physical lines to handle a much larger number of active sessions. The CONVERSANT I treats the data base host as an individual transaction server while also managing user sessions with its built-in state machine.

The user's contact with the quote service depends on a catalog which gives stocks numeric IDs. Current speech recognition capability permits nine-digit encoded strings made up of the words "one" through "nine" to map to 9^9 items with a string accuracy greater than 95 percent. Redundancy and error correction are built into the coded strings. This numeric data log approach has widespread applicability in the areas of order entry, menu selection, and information retrieval.

Marketing Outlook

Since the AT&T CONVERSANT I Voice System provides conversational access to computer information from any telephone, it is flexible and efficient in supporting a range of input and output modalities. By marketing it through a variety of channels, AT&T plans to develop complete application solutions for business computer problems that arise.

Fig. 4



The CONVERSANT I System can operate alone or as a front-end processor to one or more host computers.

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FOR MORE INFORMATION

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D69240.0101 - MMcN/002

Declassified per 2010 NARA

United States Patent [19]

Bestler et al.

[11] **Patent Number: 4,755,872**

[45] **Date of Patent: Jul. 5, 1988**

[54] **IMPULSE PAY PER VIEW SYSTEM AND METHOD**

[75] Inventors: **Charles B. Bestler**, Oak Park; **Gordon E. Reichard, Jr.**, Rolling Meadows; **Thomas J. Rossen**, Oak Park; **Semir Sirazi**, Chicago, all of Ill.

[73] Assignee: **Zenith Electronics Corporation**, Glenview, Ill.

[21] Appl. No.: **760,218**

[22] Filed: **Jul. 29, 1985**

[51] **Int. Cl.**[4] **H04M 11/08**; H04M 15/00; H04N 7/10; H04H 9/00

[52] **U.S. Cl.** **358/86**; 379/105; 379/246

[58] **Field of Search** ..... 179/2 A, 5.5, 18 FH; 358/84, 86, 349; 455/2, 4, 5; 379/102, 104, 105, 127, 142, 246

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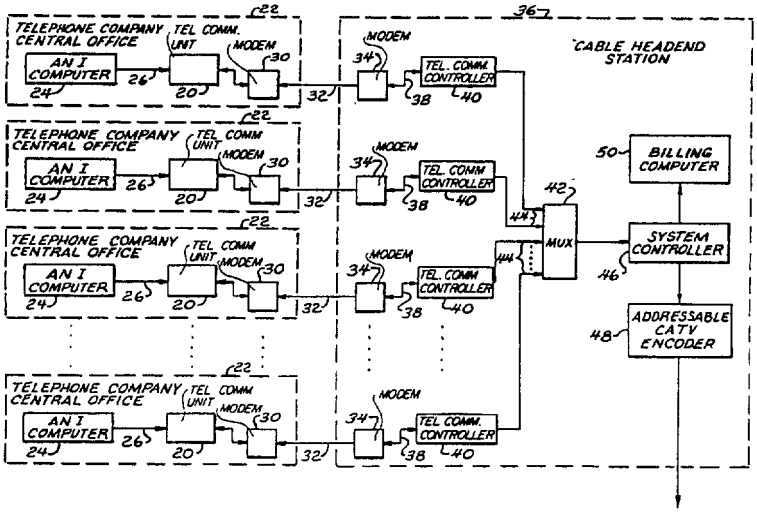
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Primary Examiner—Keith E. George

[57] **ABSTRACT**

An IPPV technique is provided for a cable system having one-way addressable converters. Each of several central offices in a metropolitan area will provide ANI information representing the cable subscriber's phone number and a code representing the cable event to be viewed or cancelled. The data is sent asynchronously to a respective telephone communication unit located at the central office. This telephone communication unit (TCU) does some buffering, eliminates unnecessary data, and sends data synchronously to a telepone communication controller (TCC) located at the cable headend station. The TCC will acknowledge the data. There will be several TCCs located at the cable headend station corresponding to the several central offices who may give telephone service to the cable operator's subscribers. All of these TCCs at the headend station are coupled through a multiplexer to a system controller. Each TCC provides intermediate processing which converts the subscriber's telephone number into binary. The multiplexer provides buffering, flow control, and arbitration among various TCCs. The multiplexer adapts to data flow conditions. The system controller receives data from each subscriber, locates a corresponding home terminal unit address, examines the password and other information, and maps the two digit program identification which was entered by the subscriber into an authorization code. It then authorizes the home terminal units in accordance with the IPPV requests by transmitting the subscriber's cable address and a new authorization code in the vertical blanking interval, generates the commercial transaction, and downloads the transaction to a billing system.

63 Claims, 12 Drawing Sheets



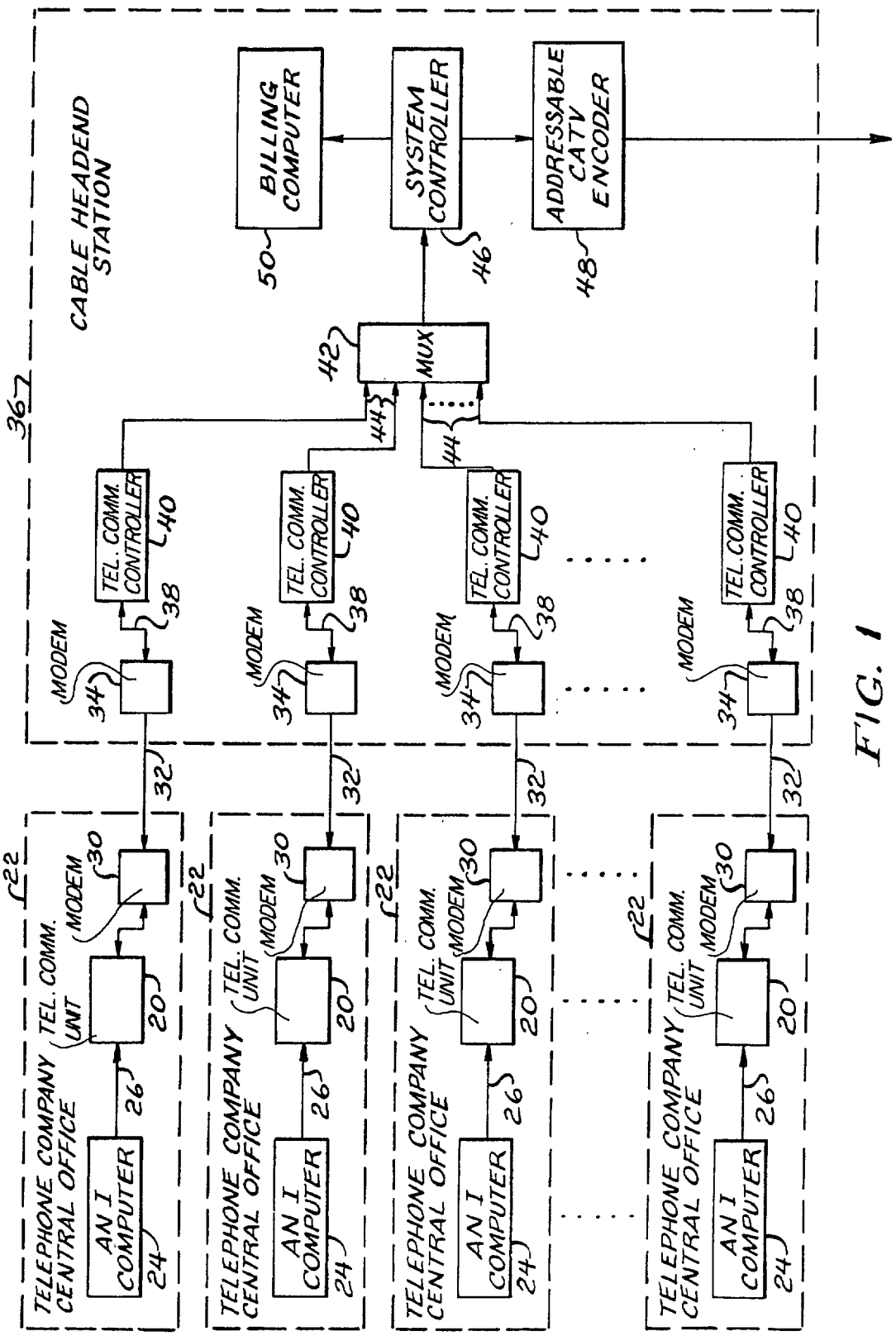

CABLE HEADEND STATION
36
BILLING COMPUTER
50
SYSTEM CONTROLLER
46
ADDRESSABLE CATV ENCODER
48
MUX
42
44
44
TEL. COMM. CONTROLLER
40
MODEM
34
38
32
TELEPHONE COMPANY CENTRAL OFFICE
22
TEL. COMM. UNIT
20
MODEM
30
ANI COMPUTER
24
26

FIG. 1

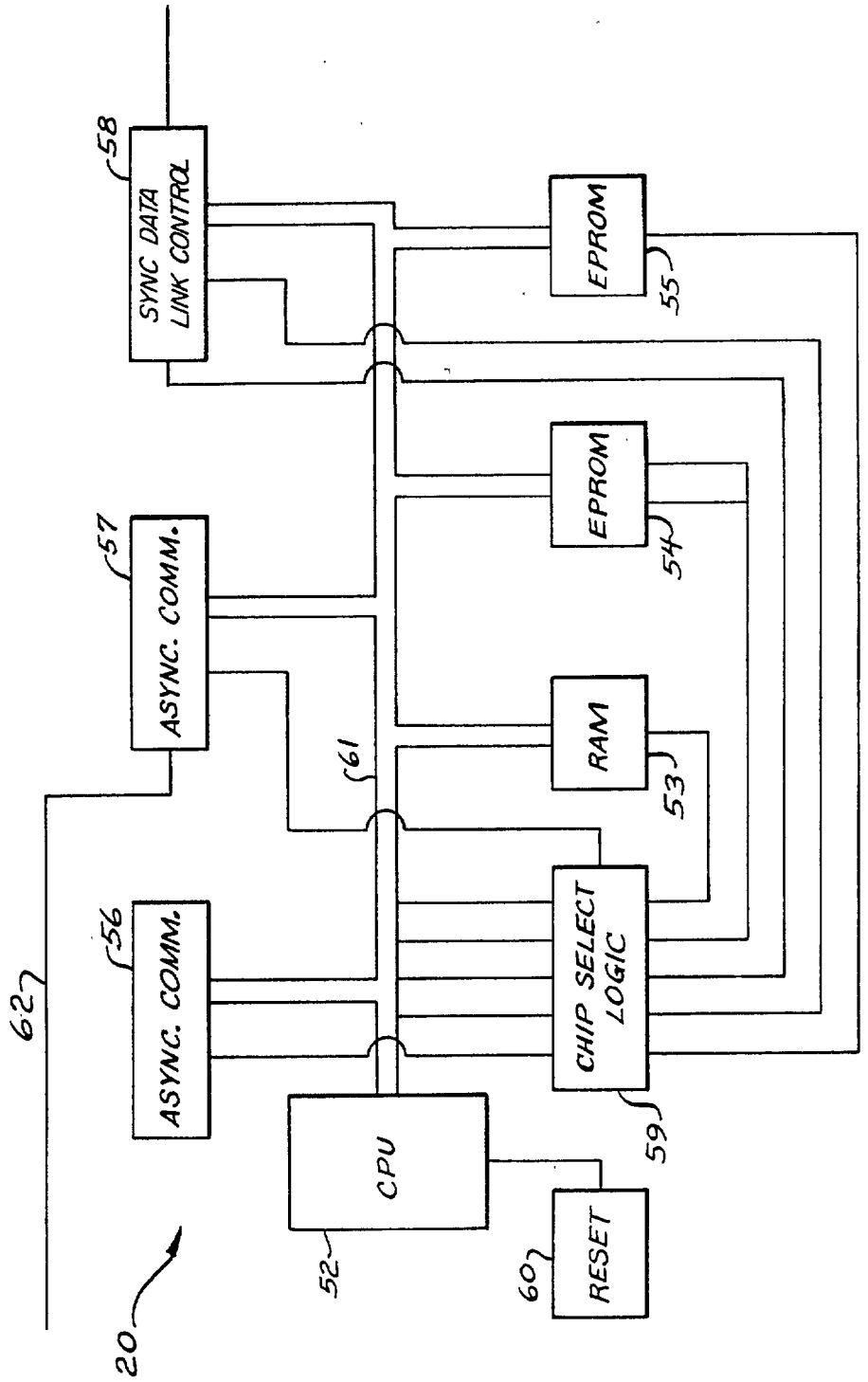
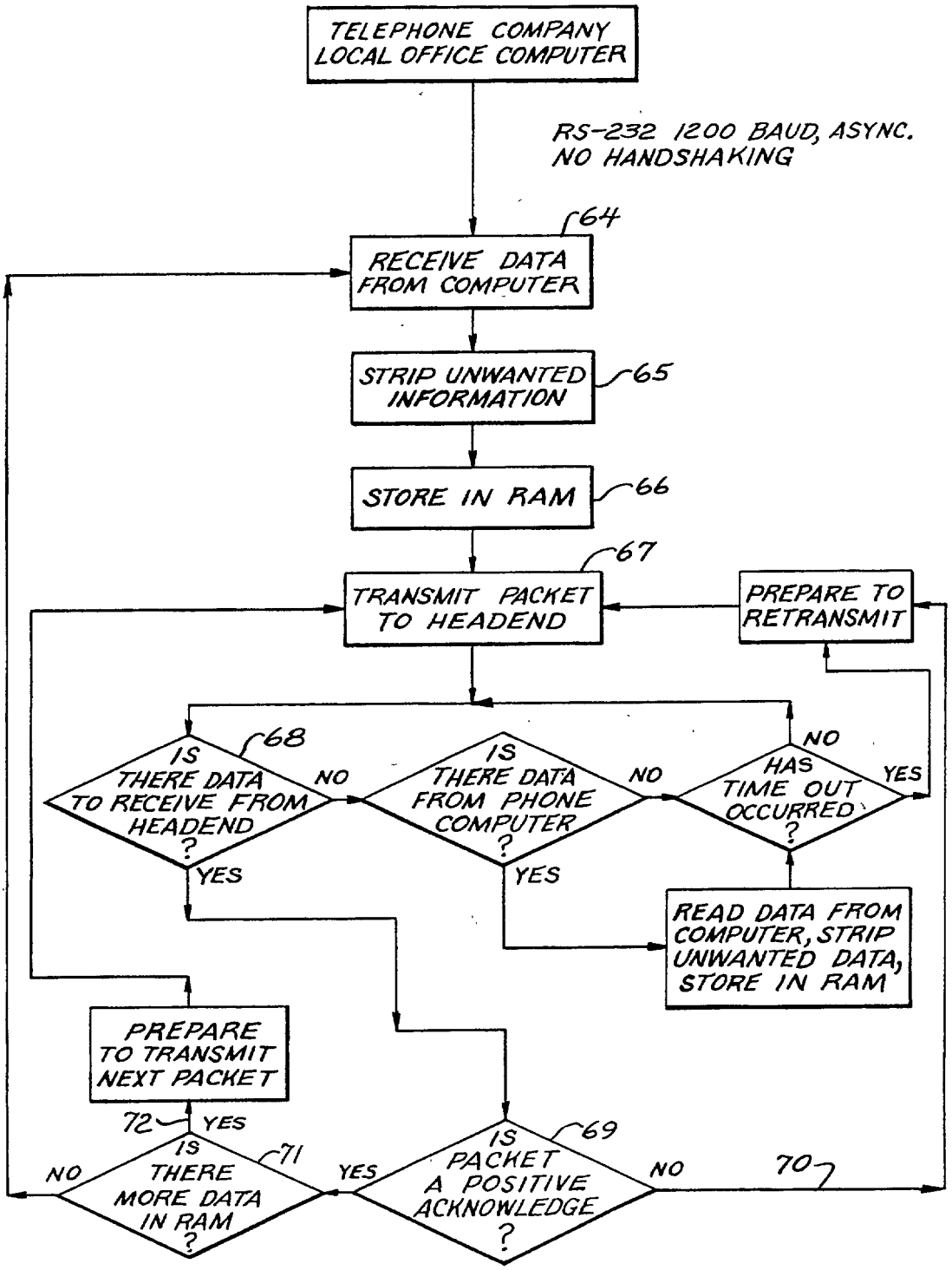

58
SYNC DATA LINK CONTROL
EPROM
55
EPROM
54
57
ASYNC. COMM.
61
RAM
53
56
ASYNC. COMM.
62
CHIP SELECT LOGIC
59
CPU
52
60
RESET
20

FIG. 2

FIG.3


TELEPHONE COMPANY LOCAL OFFICE COMPUTER
RS-232 1200 BAUD, ASYNC. NO HANDSHAKING
64
RECEIVE DATA FROM COMPUTER
STRIP UNWANTED INFORMATION
65
STORE IN RAM
66
67
TRANSMIT PACKET TO HEADEND
PREPARE TO RETRANSMIT
68
IS THERE DATA TO RECEIVE FROM HEADEND ?
NO
YES
IS THERE DATA FROM PHONE COMPUTER ?
NO
YES
HAS TIME OUT OCCURRED ?
NO
YES
READ DATA FROM COMPUTER, STRIP UNWANTED DATA, STORE IN RAM
PREPARE TO TRANSMIT NEXT PACKET
72
YES
IS THERE MORE DATA IN RAM ?
71
NO
YES
IS PACKET A POSITIVE ACKNOWLEDGE ?
69
NO
70

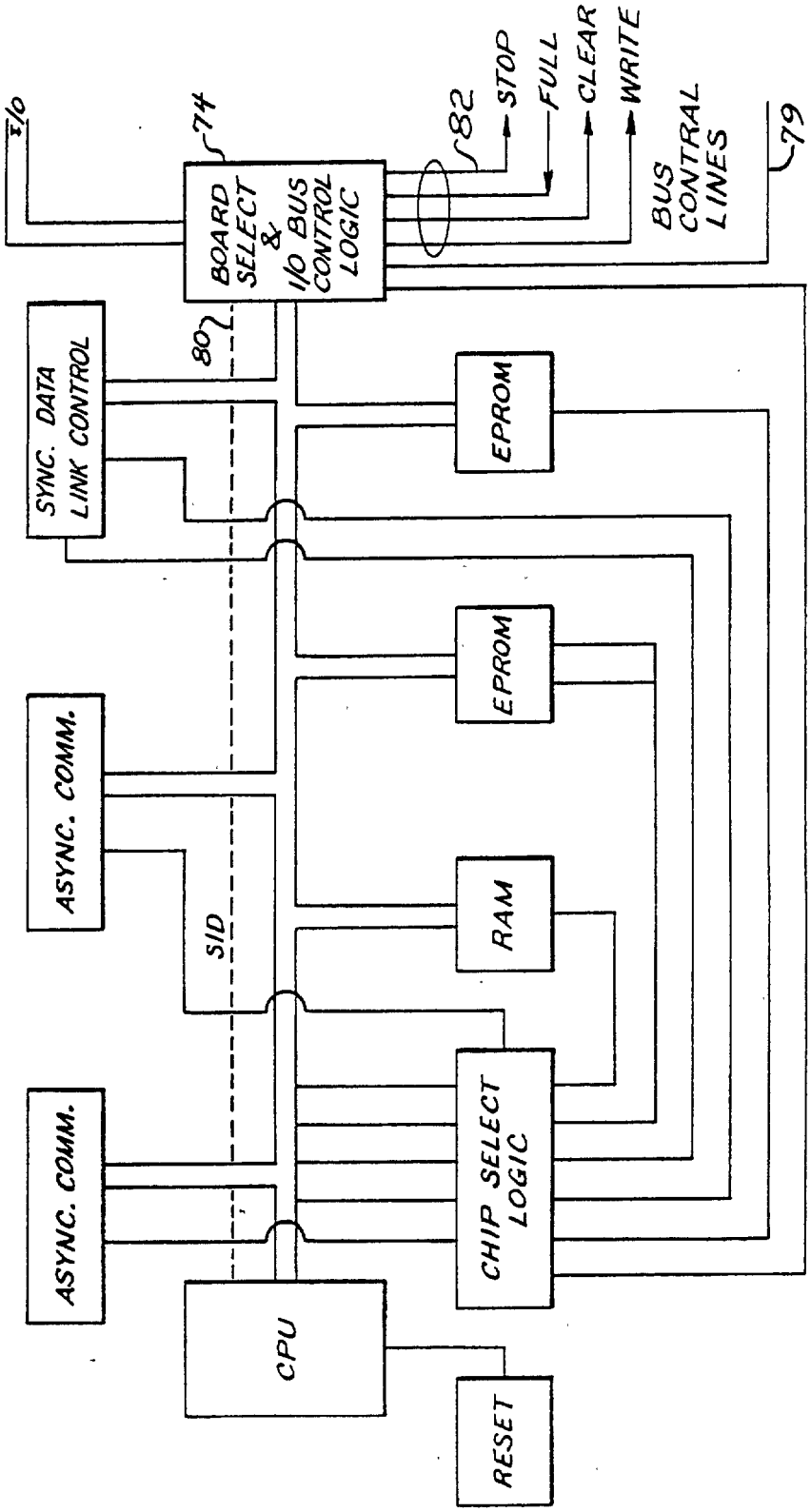

I/O
74
BOARD SELECT & I/O BUS CONTROL LOGIC
82
STOP
FULL
CLEAR
WRITE
BUS CONTRAL LINES
79
80
SYNC. DATA LINK CONTROL
EPROM
EPROM
ASYNC. COMM.
SID
RAM
ASYNC. COMM.
CHIP SELECT LOGIC
CPU
RESET

FIG. 4A

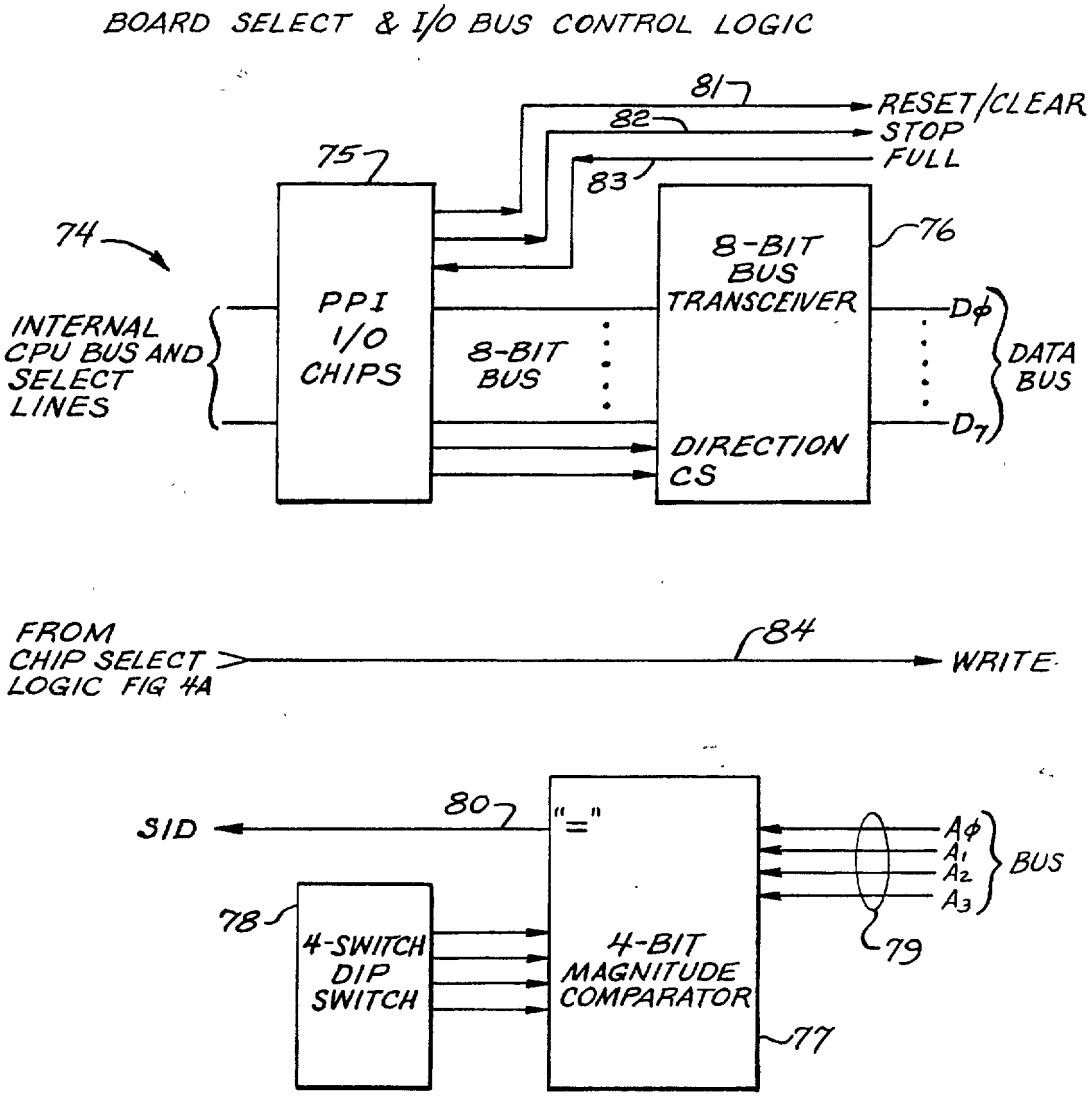

BOARD SELECT & I/O BUS CONTROL LOGIC
81
RESET/CLEAR
82
STOP
FULL
75
83
74
8-BIT BUS TRANSCEIVER
76
INTERNAL CPU BUS AND SELECT LINES
PPI I/O CHIPS
8-BIT BUS
Dϕ
D7
DATA BUS
DIRECTION CS
FROM CHIP SELECT LOGIC FIG 4A
84
WRITE
SID
80
"="
Aϕ
A1
A2
A3
BUS
78
4-SWITCH DIP SWITCH
4-BIT MAGNITUDE COMPARATOR
79
77

FIG. 4B

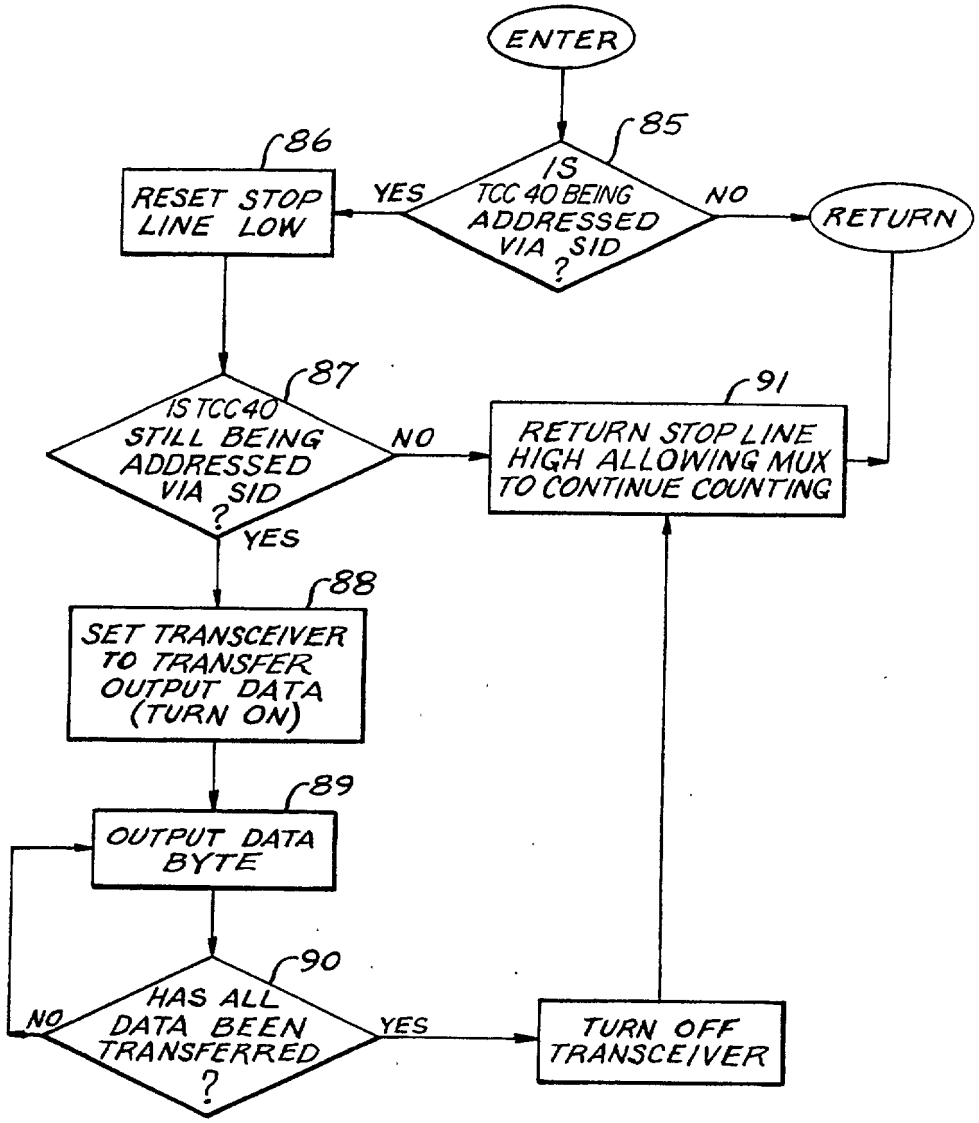

ENTER
85
IS TCC 40 BEING ADDRESSED VIA SID ?
YES
NO
RETURN
86
RESET STOP LINE LOW
87
IS TCC 40 STILL BEING ADDRESSED VIA SID ?
NO
YES
91
RETURN STOP LINE HIGH ALLOWING MUX TO CONTINUE COUNTING
88
SET TRANSCEIVER TO TRANSFER OUTPUT DATA (TURN ON)
89
OUTPUT DATA BYTE
90
HAS ALL DATA BEEN TRANSFERRED ?
NO
YES
TURN OFF TRANSCEIVER

FIG. 4C

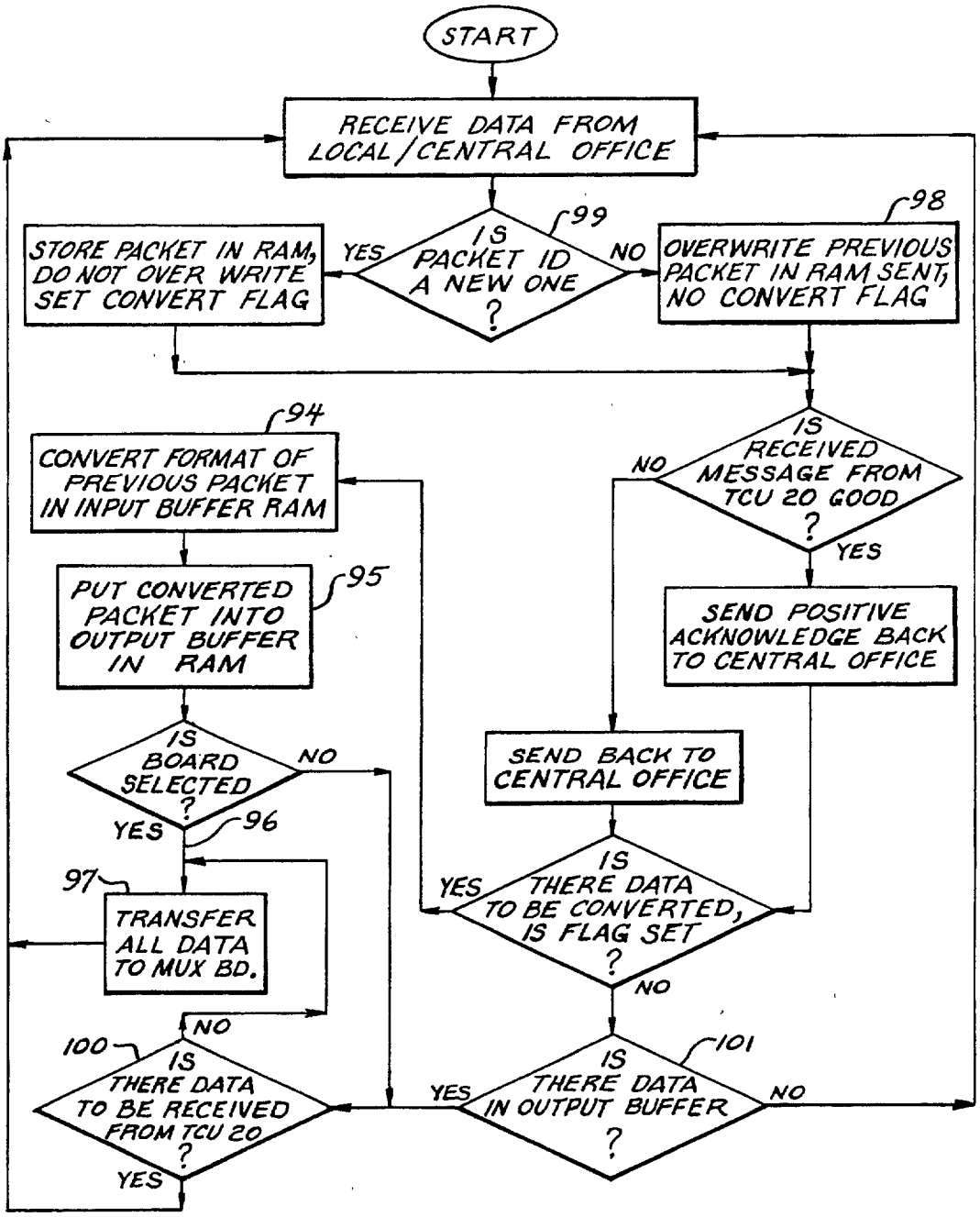

START
RECEIVE DATA FROM LOCAL/CENTRAL OFFICE
99
IS PACKET ID A NEW ONE ?
YES
NO
STORE PACKET IN RAM, DO NOT OVER WRITE SET CONVERT FLAG
98
OVERWRITE PREVIOUS PACKET IN RAM SENT, NO CONVERT FLAG
94
CONVERT FORMAT OF PREVIOUS PACKET IN INPUT BUFFER RAM
IS RECEIVED MESSAGE FROM TCU 20 GOOD ?
NO
YES
95
PUT CONVERTED PACKET INTO OUTPUT BUFFER IN RAM
SEND POSITIVE ACKNOWLEDGE BACK TO CENTRAL OFFICE
IS BOARD SELECTED ?
NO
YES
96
SEND BACK TO CENTRAL OFFICE
97
TRANSFER ALL DATA TO MUX BD.
IS THERE DATA TO BE CONVERTED, IS FLAG SET ?
YES
NO
NO
100
IS THERE DATA TO BE RECEIVED FROM TCU 20 ?
YES
101
IS THERE DATA IN OUTPUT BUFFER ?
YES
NO

FIG. 5

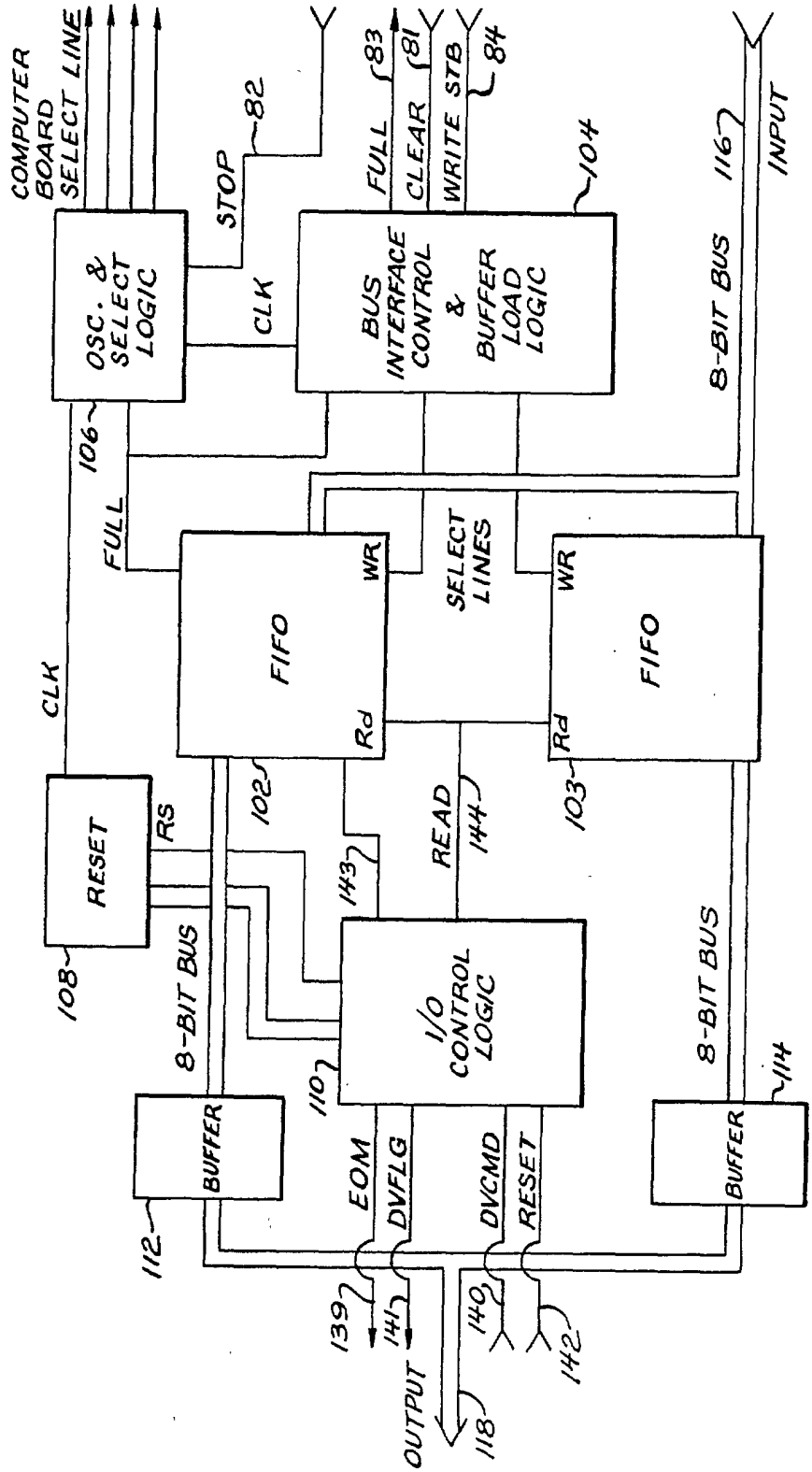

COMPUTER BOARD SELECT LINE
OSC. & SELECT LOGIC
STOP
82
CLK
BUS INTERFACE CONTROL & BUFFER LOAD LOGIC
FULL
83
CLEAR
81
WRITE STB
84
104
8-BIT BUS
116
INPUT
106
FULL
CLK
FIFO
WR
Rd
SELECT LINES
FIFO
WR
Rd
RESET
RS
102
READ
144
103
108
8-BIT BUS
143
I/O CONTROL LOGIC
110
8-BIT BUS
114
BUFFER
BUFFER
112
EOM
DVFLG
DVCMD
RESET
139
141
140
142
OUTPUT
118

FIG. 6A

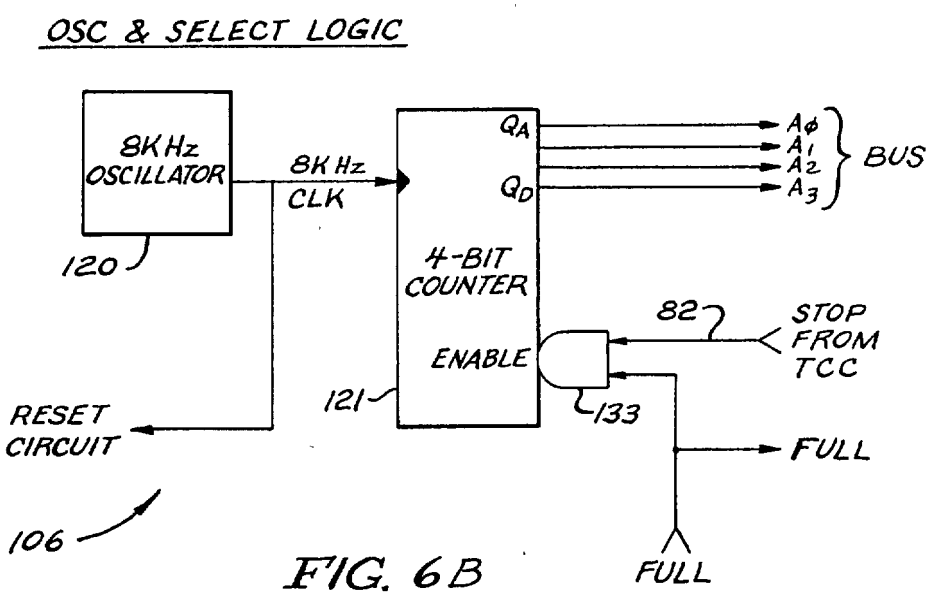

OSC & SELECT LOGIC
8KHz OSCILLATOR
120
8KHz CLK
Q_A
Q_D
4-BIT COUNTER
ENABLE
121
82
STOP FROM TCC
133
A_0
A_1
A_2
A_3
BUS
RESET CIRCUIT
106
FULL
FULL

FIG. 6B

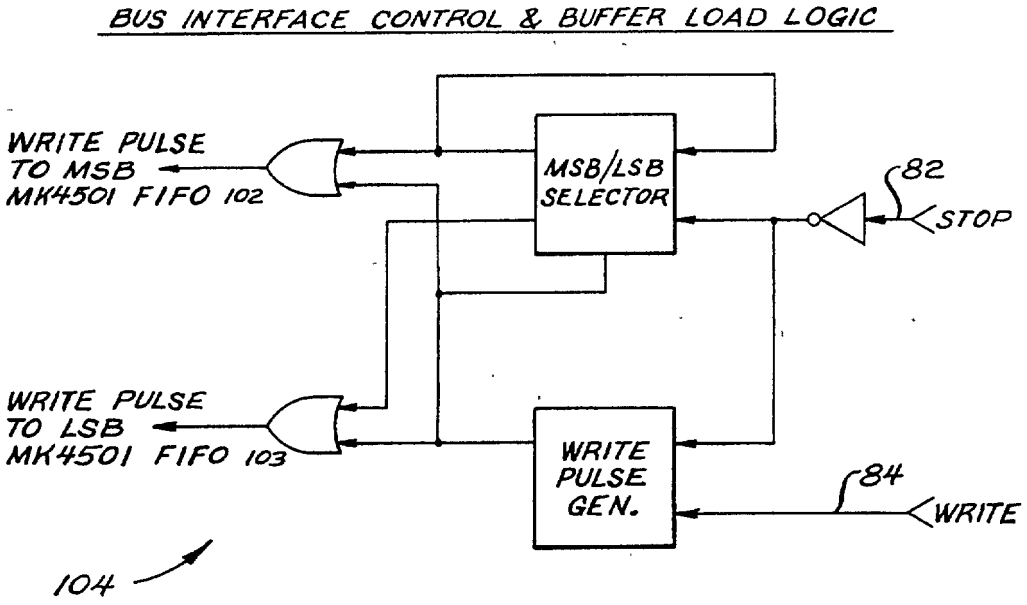

BUS INTERFACE CONTROL & BUFFER LOAD LOGIC
WRITE PULSE TO MSB MK4501 FIFO 102
MSB/LSB SELECTOR
82
STOP
WRITE PULSE TO LSB MK4501 FIFO 103
WRITE PULSE GEN.
84
WRITE
104

FIG. 6C

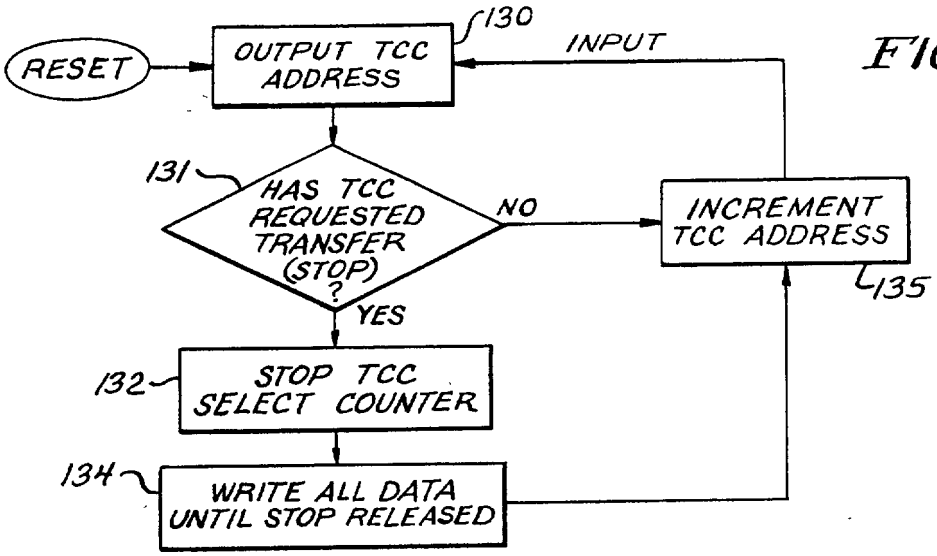


FIG. 7

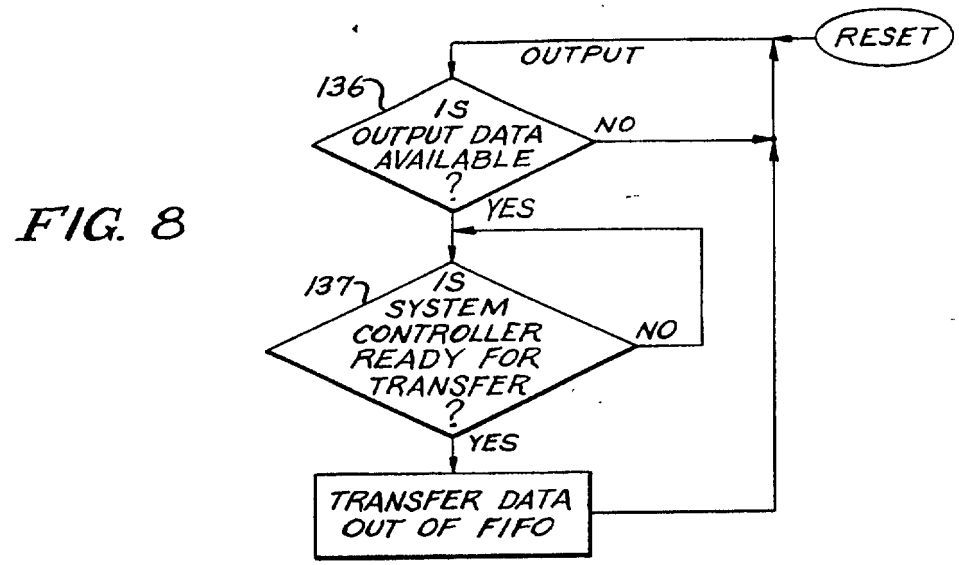
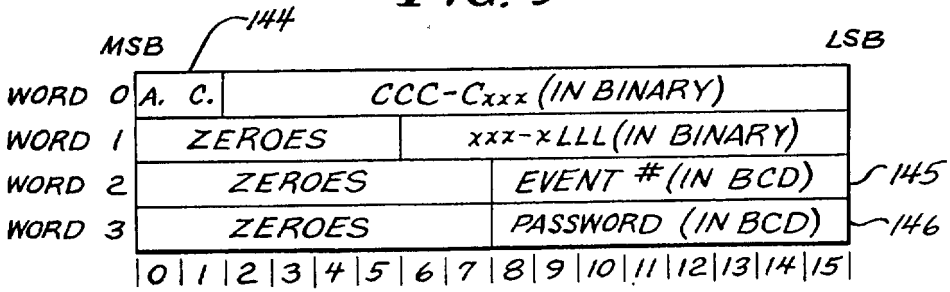


FIG. 8

FIG. 9



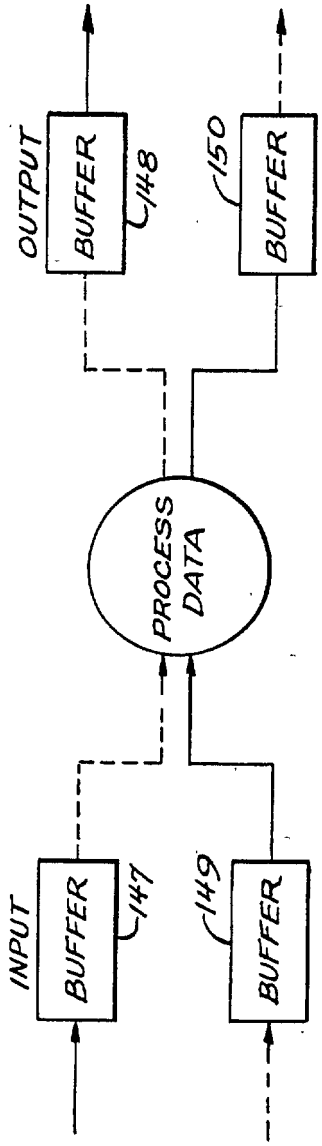

INPUT BUFFER
147
149
BUFFER
PROCESS DATA
OUTPUT BUFFER
148
150
BUFFER

FIG. 10

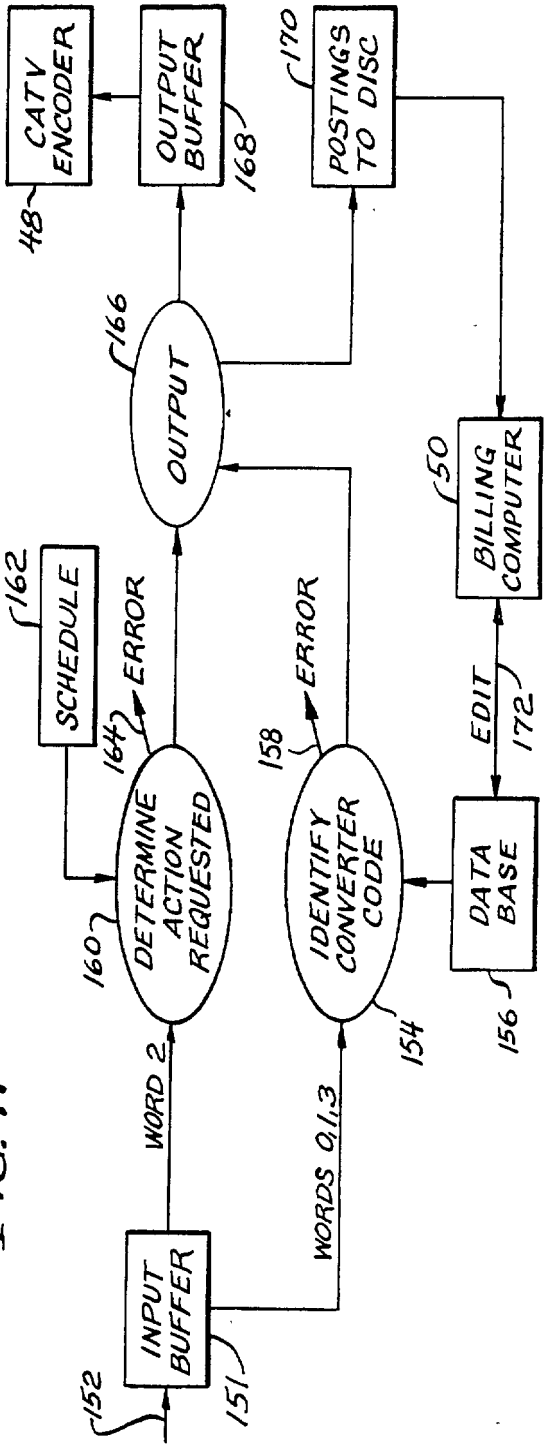

INPUT BUFFER
151
152
WORD 2
WORDS 0,1,3
DETERMINE ACTION REQUESTED
160
IDENTIFY CONVERTER CODE
154
DATA BASE
156
SCHEDULE
162
ERROR
164
ERROR
158
OUTPUT
166
CATV ENCODER
48
OUTPUT BUFFER
168
POSTINGS TO DISC
170
EDIT
172
BILLING COMPUTER
50

FIG. 11

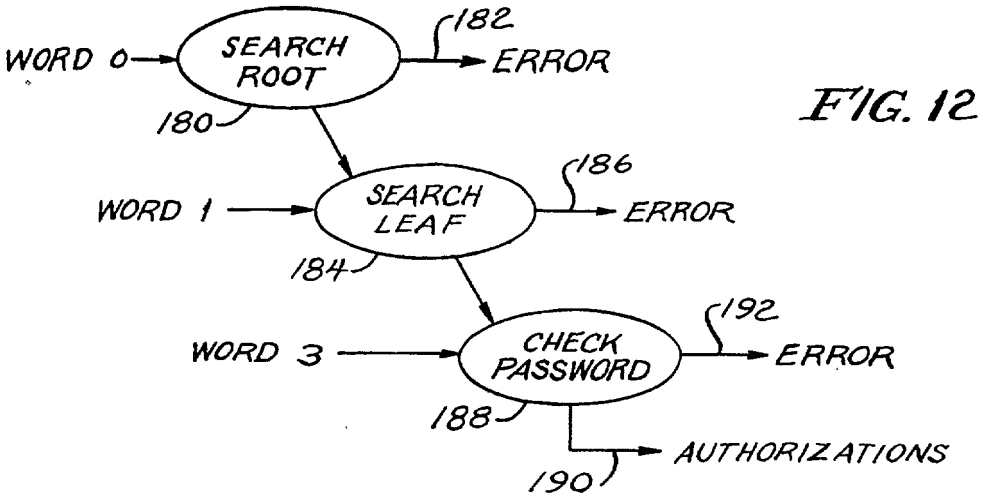

WORD 0
SEARCH ROOT
182
ERROR
180
WORD 1
SEARCH LEAF
186
ERROR
184
WORD 3
CHECK PASSWORD
192
ERROR
188
AUTHORIZATIONS
190

FIG. 12

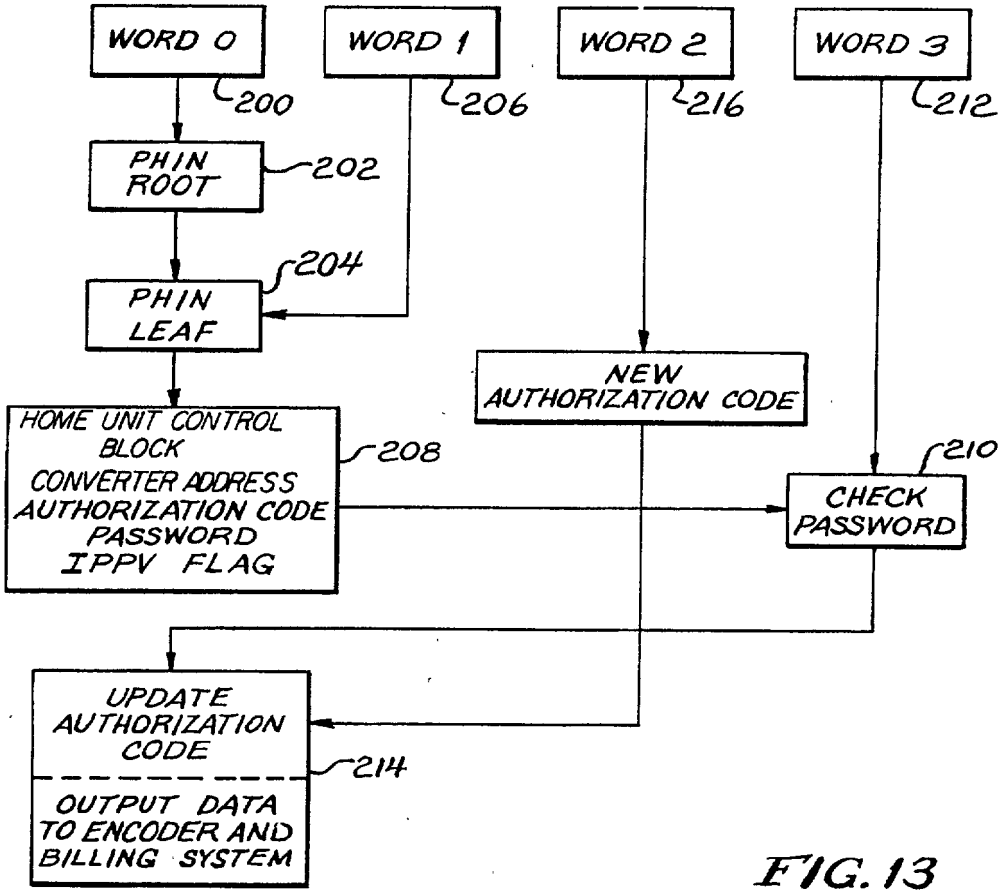

WORD 0
200
WORD 1
206
WORD 2
216
WORD 3
212
PHIN ROOT
202
204
PHIN LEAF
NEW AUTHORIZATION CODE
HOME UNIT CONTROL BLOCK
CONVERTER ADDRESS
AUTHORIZATION CODE
PASSWORD
IPPV FLAG
208
210
CHECK PASSWORD
UPDATE AUTHORIZATION CODE
214
OUTPUT DATA TO ENCODER AND BILLING SYSTEM

FIG. 13

IMPULSE PAY PER VIEW SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

The present invention relates to cable television and particularly to a technique whereby a cable subscriber can send a request via telephone to the cable operator to receive only a selected cable program. This is known as an "impulse pay per view" system.

The preferred embodiment of the present invention is compatible with one-way addressable CATV systems. Prior to describing the invention, it will be useful to have a rudimentary understanding of a typical one-way addressable CATV system. In use, a cable operator at a "headend" station receives signals via satellite, microwave, and super trunks, encodes the signals, modulates them, and provides them to the cable plant. The cable plant is a distribution network typically carrying up to 80 channels or more over a distance of up to 20 miles or so to various subscribers. Each of the cable subscribers is provided with a one-way addressable converter (also called a decoder) which is connected to the cable and to a television receiver or monitor. The basic function of the converter is to interface the cable signals with the subscriber according to authorization codes received from the headend. The subscriber will select a channel containing a program desired to be viewed. The converter will determine whether that channel or program on the channel is authorized for viewing by the subscriber. If so, the converter descrambles the selected signal provided by the cable operator and provides a descrambled signal to the television receiver or monitor. The scrambling may, for example, be done by sync suppression wherein sync information is randomly suppressed, as well as video inversion.

To achieve the foregoing system, use may be made of the vertical blanking interval, e.g. line numbers **10, 11, 12** and **13**, or an out-of-band data channel during which information can be transmitted by the headend station to the subscribers or any selected subscriber. Each converter has a respective unique address code illustratively having 20 binary bits so that over one million subscribers can be individually addressed by the headend. Additionally, each converter typically includes a random access memory (RAM) which is capable of storing 20 bits, for example. Each of the stored bits is representative of a service or channel which may be subscribed to. Typically, at installation, the RAM is loaded with all zero bits. When the subscriber chooses the services he wants, that information will be entered as data in a subscriber data base. The subscriber data base is accessed by a system controller at the headend station which is capable of addressing any or all of the converters in the field. The system controller also communicates with a billing and management computer.

More particularly, in this example the system controller transmits a selected 20 bit address code (sometimes referred to as an "identification code") followed by an associated authorization code using each of line numbers **10, 11**, and/or **12** in the vertical blanking interval. Each converter receives the 20 bit address code, but only one converter will decode it as matching its own unique address. Following the transmitted 20 bit address code are the five bits of the authorization code. These five authorization bits will be loaded into a proper location in the RAM, the location having been determined by information from line **13** in the prior field. The RAM in the converter will illustratively contain 20 bits arranged in four groups which may be called row A, row B, row C, and row D. Illustratively, the five bit authorization code will be loaded into one of the rows of the RAM. Line number **13** of the vertical interval is used to transmit a "program tag," a "market code," and further information to the converters in the field. The market code is used to prevent a converter from being taken from one cable market to another market. The transmitted program tag is used to identify a particular channel or program and is compared in the addressed converter with the stored authorization bits to establish whether that converter is authorized to descramble the corresponding program material. Illustratively, this is done by performing a logical AND operation between the 5 bit program tag transmitted on line **13** of the channel which has been selected by the subscriber with the content of a selected row of the RAM. The result of this logical operation will indicate to the converter whether the selected channel or program on the channel has been authorized to be descrambled by the converter. It will be appreciated that each of the channels transmitted by the cable operator has its own respective program tag. This particular system has exceptional versatility in that the contents of the RAM at any subscriber's converter can be changed instantly via the system controller through the transmission of the appropriate address code during the vertical blanking interval followed by updated information for storage in the RAM. Moreover, there can be tiers of authorization wherein various programs on a given channel will be authorized for some subscribers but not for others, depending on the service to which they have subscribed. For further information about one such addressable system, refer to Ensinger and Hendrickson U.S. Pat. No. 4,460,992, whose disclosure is hereby incorporated, which patent is owned by Zenith Electronics Corp.

To date, the market penetration of cable systems has been on the order of only 50 percent. Some television owners prefer not to pay the monthly charges for cable service to receive one or more of the packages or services provided by the cable operator. These non-subscribers, however, may be willing to pay the cable operator for only an occasional program. Such type of service is called "pay per view." In order to achieve this and to provide control over billing, the cable operator must have information regarding what programs are desired by various subscribers. In an addressable CATV system of the type described above, for example, a particular subscriber's converter may be updated so that it will descramble a given program—once it is determined that the subscriber is wlling to pay for that program. This can be done by having the subscriber telephone the cable operator in advance of the program to be purchased, mail a postcard, or communicate by some other means.

The problem with this type of service, however, is that it precludes impulse purchases and simultaneous response from the time the pay-per-view subscriber determines he wishes to purchase a particular program and the time it is actually viewed by him. It would be considerably more advantageous to permit a subscriber to obtain immediate results by, for example, pushing a button. This would alert the cable operator to a request for service. The system controller at the headend station immediately would change the contents of the

RAM at that subscriber's converter to permit the selected program to be descrambled. This is called "impulse pay per view" (IPPV) service.

The problem facing the industry is how to provide a system permitting IPPV service. In 1975, the Federal Communications Commission mandated that all cable systems being installed would be required to have two-way communications capability. This would permit interaction between the subscriber and the headend station. To date, about 20 percent of installed systems are capable of two-way communications, and of these only about one-half have active two-way communication. With two-way communication, the subscriber can use his home terminal or other unit to communicate with the headend station and achieve IPPV. The problem, however, resides in providing a mechanism for other subscribers served by one-way cable systems, which constitute the vast majority to have IPPV service.

For cable subscribers without two-way cable systems, a hybrid system is required for impulse pay per view service. This involves a telephone request by a subscriber for a PPV cable event followed by delivery from the cable operator headend station to the individual subscriber of a new authorization level permitting the PPV cable event to be descrambled.

The problem with hybrid systems using the telephone is substantial. The telephone system in a given city or community includes one or more central offices, each communicating with up to about 50,000 telephone subscribers. Each of the several central offices communicates with the others by trank cables. The headend station of the cable operator will be located within a region serviced by one central office. When cable subscribers telephone for pay per view service, their telephone central offices will route all of the telephone calls to the one central office servicing the headend station. Too many telephone requests at the same time to the cable operator can cause the telephone central office to "crash" due to excessive requests for physical telephone connections between numerous telephone subscribers and a single cable operator headend station. This problem is common to all hybrid systems, whether a manual telephone system or an automatic dialing system is used.

Further problems attend manual call-in systems and auto-dialing systems. The manual call-in systems are labor intensive, require long processing and holding time, have limited capacity, are not impulse in nature, and have lower penetration. They also involve possible human error. Auto-dialing systems have an advantage over manual systems, except that there is the additional expense of in-home installation of the automatic dialer.

To avoid overloading on the telephone system, one solution to providing IPPV service for one-way addressable cable systems would be to refrain from making physical telephone connections between the cable subscribers and the headend station through the various central offices. To achieve this, a new system based on automatic number identification passing referred to as "ANI passing" has been developed. ANI passing is an upgrade achieved by adding software to some central offices or by adding hardware to others, depending on their existing capabilities. In ANI passing, the central office of the telephone company will collect information based on each subscriber telephone call and pass it on to other equipment.

Thus, when a cable subscriber intends to make an IPPV request and picks up his telephone (takes it "off-hook"), a dial tone is issued to the subscriber's premises by the telephone company, and the telephone number is automatically identified, as customary within the telephone company. Now the cable subscriber can enter information using the telephone. Typically, to place a phone call, seven digits (or ten, if an area code is needed) are entered. To use ANI passing, however, some prescribed sequence of digits is used. This can take vertically any form. For example, the subscriber may enter "*85" or any other prescribed NNX number (exchange number) and then some number of digits, such as four further digits. In general, however, the total number of digits need not be seven, so long as some prescribed subscriber-entered information alerts the telephone company central office *not* to make a physical connection between the telephone subscriber and whatever location is identified by the code which follows the reserved block of codes which follows the NNX (or *85 signal). After dialing the NNX number, for example, the cable subscriber will provide further information on the telephone by sending illustratively four digits. Hence the telephone transmission to the central office may take the following form: NNX-YVVZ. In this illustrative example, the code represented by NNX activates the ANI passing system at the central office. The remaining four digits YVVZ identify what the subscriber wants to do. Illustratively, the Y digit is used to identify the cable company. In any given metropolitan area, there will be fewer than ten different cable operators, so the one digit (Y) will be able to identify the cable operator uniquely. Illustratively, the next two digits represented by VV identify the event or cable television program which the cable subscriber wishes to purchase. Next, the Z digit may represent a password which is useful for security purposes. For example, within a given household where a cable television system has been installed, parents may, through the use of a password, prevent access by children to certain types of pay per view programming. Alternatively, the Z digit can be used for other purposes. In using *85, five digits can be entered by the cable subscriber to his telephone, for a total of, for example, seven digits preceded by one special character. One of the digits may identify the cable company, two of the digits may identify the cable event to be purchased (or canceled), and two digits may be used as a password. It will be understood that these are purely illustrative, and that wide variation can occur.

As mentioned, the NNX or *85 message tells the telephone central office that it need not make a physical connection. This avoids overburdening the telephone plant. In response to receiving such an ANI transmission, the receiving telephone central office will collect and store data. Then, it will communicate by the system of the present invention with the cable headend station which has been "telephoned" and provide it with various information, including the telephone number of the cable subscribers who called, the user entered data, and various other information. In an area served by plural cable companies, the equipment at the telephone company central offices will send data, using the present invention, to the plural cable companies.

The object of the present invention is to provide a system which will receive information from the telephone company central offices and implement the impulse pay per view requests by cable subscribers in a satisfactory manner.

A related object of the invention is to provide a system having the ability to receive data from the telephone companies as fast as the information can be provided using the ANI passing systems.

Another object of the present invention is to permit the authorizations of the subscribers to be checked in real time.

A further object is to translate the telephone number of the cable subscriber (provided by the telephone company) into a cable subscriber code at a fast rate.

BRIEF DESCRIPTION OF THE DRAWINGS

In describing the various aspects of the present invention, reference will be made to the accompanying drawings wherein:

FIG. 1 is a block diagram of a system according to the present invention showing plural central offices and a headend station;

FIG. 2 is a block diagram of one of the several telephone communication units (TCUs);

FIG. 3 is a flow chart of the TCU software;

FIGS. 4A and 4B are diagrams of the telephone communication controller (TCC) located at the cable headend station, and FIG. 4C is a flow chart of part of the TCC operations pertaining to adaptive window multiplexing;

FIG. 5 is a flow chart of the TCC software;

FIGS. 6A, 6B and 6C are diagrams of the multiplexer circuitry;

FIG. 7 describes the inputting of data to the multiplexer from the TCC;

FIG. 8 describes the outputting of data from the multiplexer to the system controller;

FIG. 9 shows the message format of the data sent from the multiplexer to the system controller;

FIG. 10 shows the phase inverted synchronous input/output buffer system used in the system controller;

FIG. 11 is a sketch illustrating processing by the system controller, CATV encoder, and billing computer;

FIG. 12 is a sketch showing the two level searching used in the mapping algorithm applied in the system controller; and

FIG. 13 illustrates further how the four words sent to the system controller are processed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a block diagram of a system according to the present invention. The preferred embodiment of the invention is the Zenith PHONEVISION system. As shown, the system comprises a plurality of telephone communication units (TCUs) 20 each located at a corresponding telephone company central office 22. Several central offices 22 are shown in FIG. 1 to indicate the several central offices of any metropolitan area. In the preferred embodiment of the present invention there may be as many as sixteen central offices. Also located at the telephone company central office is an automatic number identification (ANI) computer 24. The ANI computer is provided by the phone company and is activated upon receipt of a telephone call from a customer utilizing a special ANI telephone code. The ANI computer then provides specific information to its TCU on a cable 26.

Coupled to each telephone communication unit 20 is a corresponding modem 30. Modems 30 are coupled via leased telephone lines 32 or other communication channels to corresponding modems 34 located at a cable headend station 36. Each modem 34 is coupled by a cable 38 to a respective telephone communication controller (TCC) 40. The TCCs 40 are in turn coupled to a multiplexer 42 by a bus 44. Multiplexer 42 selects which one of the TCCs corresponding to the various telephone company central offices will supply data to a system controller 46. The system controller in turn is coupled to a cable TV encoder 48 as well as a billing computer 50.

In order to utilize the impulse pay per view system of the preferred embodiment described herein, a cable television subscriber would tune his addressable cable television decoder to the desired channel. The cable subscriber would then use his telephone to enter the ANI telephone code and then four or more digits. Two of the digits entered by the cable subscriber signify the particular IPPV cable event the subscriber wishes to view. Two of the other digits for illustrative purposes constitute a password number or could be used to identify which of a plurality of encoder units the subscriber wishes to enable for the desired cable event.

The telephone company central office 22 serving the cable subscriber's telephone area will be alerted by the ANI code so that when it receives the call, it will transform the "dialed" phone number (called the "destination telephone number") and other data into the so-called bulk calling line identification (BCLID) format by using the ANI computer. It will be understood that other protocols can be used by the telephone company, and that the present invention is not limited to the specific protocol adopted. In any event, the telephone company central office will not connect the incoming call from the cable subscriber to its local switch. Thus, the telephone company central offices will not become overburdened with the incoming calls from numerous cable subscribers who may all be calling on impulse to purchase a particular cable event.

The ANI computer at the telephone company central office will send the BCLID data (using seven bit ASCII code) to the TCU 20 located at the central office. The data is sent serially at 1200 baud in RS-232 format. The BCLID message contains ASCII characters representing the seven digit "destination telephone number," the ten digit origination telephone number, as well as considerable other data such as carriage return and line feed, a BCLID input/output message identifier, numerous ASCII spaces, the time of day in hours, minutes and seconds, the terminating line status and the calling line status indicator. The data sent in the telephone company's BCLID format is shown in Table I.

The "destination telephone number" carries the information entered by the cable subscriber. This will include the cable event which is to be purchased and the password. Ordinarily, this will comprise the last four of the seven digits entered by the subscriber, although any number of digits could be entered, and of these, any number could be dedicated to identifying the program to be purchased, a password, an identifier of which particular converter box at the subscriber's premises is to be used, and any other information deemed necessary or desirable by the cable company.

TABLE I

Format of BCLID Message Sent By ANI Computer 24 to TCU 20

<cr-lf>BCsaabbccssddddddsoooooooooosfsgs<cr-lf>	
<cr-lf>	All messages start and stop with carriage

TABLE I-continued

Format of BCLID Message Sent By ANI Computer 24 to TCU 20	
	return line feed
BC	BCLID I/O message identifier
s	ASCII "space"
aa	Hours (24 hour format)
bb	Minutes
cc	Seconds
ddddddd	7-digit "destination telephone number"
oooooooooo	10-digit origination telephone number
f	Terminating line busy, idle status, ("0" = idle, "1" = busy)
g	Calling line DN multi-status indicator

This data is sent by the ANI computer **24** to its corresponding TCU **20** asynchronously without handshaking, and can be a continual data stream.

The TCU **20** must be able to receive and transmit the data as fast as the ANI computer **24** can send it. To promote speed, each TCU **20** strips away unneeded data and temporarily stores the remaining data in a buffer. The stored data is then transmitted synchronously to the cable headend station using a telephone line **32**. Preferably, a contracted synchronous data link control (SDLC) protocol is used for transmitting the data from each TCU **20** to its corresponding TCC **40** at the cable headend station. After the data has been transmitted to the headed station, the TCU **20** waits for an acknowledgement message from the headend TCC **40** before transmitting the next data packet. If no acknowledgement or a negative acknowledgement message is received, TCU **20** retransmits the previously transmitted data packet. The TCU **20** provides for error free transmission to TCC **40** with no data loss. Since much of the unnecessary information of Table I is removed, as will be described, by the TCU **20**, and due to the buffering occurring at each TCU **20**, each TCU **20** is able to operate at a rate fast enough to keep up with ANI computer **24**. Each TCU **20** also provides for conversion of the BCLID data received from the phone company to the modified SDLC protocol format.

A block diagram of a TCU **20** located at one of the telephone central offices is shown in FIG. **2**. It includes an Intel 8085 central processing unit ("CPU") **52**, a 4K×8 static RAM **53**, a 16K×8 EPROM **54**, a 4K×8 EPROM **55**, two Intel 8250 Asynchronous Communication Elements **56**, **57**, an Intel 8273 programmable HDLC/SDLC protocol controller **58**, chip select logic **59** and watchdog reset circuitry **60**. A sixteen bit address and eight bit data bus **61** provide communication among the various components of TCU **20**. The serial data from the telephone office ANI computer **24** is applied to a serial data input pin of communication element **57** by a line **62** which is coupled to cable **26** through a line receiver (not shown). The equipment on this board, according to the preferred embodiment, has two asynchronous channels and one synchronous channel.

The CPU **52** in the preferred embodiment illustratively operates at four megahertz. Its instruction code is stored in EPROM **54**. The EPROM **55** may contain look-up tables. RAM **53** is used to buffer data packets, for stack purposes and for program use. Chip select logic **59** is used to determine whether the read or write operation is required of the memory mapped devices and to determine the exact device being addressed.

As mentioned, once the data from the telephone office ANI computer **24** is received, TCU **20** strips away unwanted data. The data that is kept is the seven digit (illustratively) "destination telephone number" entered by the cable subscriber (which includes the data the cable event to be purchased), the ten digit phone number of the cable subscriber, the terminating line status and the calling line indicator. These nineteen characters are ASCII characters, and are temporarily stored or buffered in RAM **53** to await transmission to the corresponding TCC **40** at cable headend station **36**.

FIG. **3** contains a flow chart of the software which controls the inputting of data from the telephone office ANI computer **24** and the outputting of data to the cable headend TCC **40**. A listing of the TCU software is contained in Appendix I. Referring to FIG. **3**, after data is received from ANI computer **24** at block **64**, unwanted data is stripped, temporarily stored, and then sent in packets to the headend unit as shown at blocks **65**, **66** and **67**. Then TCU **20** determines at decision diamonds **68** and **69** whether a positive acknowledgment has been received from the headend. If not, retransmission of the data packet occurs, as indicated by route **70**. If there is stored data in RAM **53**, determined at diamond **71**, further data packets are sent to the headend, as indicated by route **72**. Otherwise, data continues to be received, as always, and put into a buffer (RAM) until processed.

The nineteen ASCII characters sent by TCU **20** to its TCC **40** are sent via a line using a contracted SDLC protocol which is reflected in Appendix I. Briefly, however, the SDLC protocol is modified to preserve the package format, zero bit insertions, and the frame check sequence ("FCS code"), with all else eliminated. The data is sent synchronously, serially, at 1200 baud, and is RS-232 compatible. Handshaking is used, so that for every packet sent from the TCU **20**, a positive acknowledgment is required in the preferred embodiment before the next packet is transmitted. Table II shows the illustrative message format of the data sent from a TCU **20** to its TCC **40**. Table III shows the illustrative acknowledgment message sent from a TCC **40** to its corresponding TCU **20**.

TABLE II

Message Sent From The TCU To The TCC
[address] [packet ID]NNXDDDDAAACCCCLLLYZ[FCS] [FCS]
[ ] denotes an 8-bit quantity address = FF hex NNX = ANI identifier, e.g., *85 or 1st 3 digits of destination phone no. D = User data A = Area Code C = First 4-digits of subscriber's phone number L = Last 3-digits of subscriber's phone number Y = Terminating line status (line busy or not) Z = Calling line indicator (public line or private branch exchange) [FCS] = Frame check sequence for error checking

TABLE III

Acknowledgment Message Sent From The TCC 40 To The TCU 20
[address] [packet ID] [acknowledgment byte] [FCS] FCS]
acknowledgment byte = C3 hex for NACK = A5 hex for ACK
[ ] denotes an 8-bit quantity

It will be understood that these processes occur at each of the several central offices of the telephone company serving the cable companies areas. The system as described so far collects data in real time. The collected data are the requests of subscribers, and this is achieved using a system compatible with ANI passing. Data is sent from multiple telephone central offices to a cable headend station. The data provided includes the subscriber's telephone number and his request, which is couched in the destination telephone number.

Turning now to the cable headend station **36**, the basic functions of each TCC **40** in the preferred embodiment are to receive data packets from the several telephone central offices **22**, store the data temporarily, perform some conversions into binary and BCD, reformat the data, and communicate it quickly to system controller **46** via temporary storage in multiplexer **42**. As seen in FIG. **1**, there are several TCC units **40** corresponding to the several telephone central offices **22**.

A block diagram of an illustrative TCC **40** located at the cable headend station **36** is shown in FIG. **4A**. The same components are used in the TCC **40** as in the TCU **20**, and in the same configuration. As with TCU **20**, this board has asynchronous and synchronous capability. In TCC **40**, the synchronous ports of the Intel 8250 chips are used. Each TCC **40** additionally includes a board select and I/O bus control logic circuit **74** shown more particularly in FIG. **4B**. This circuitry illustratively comprises two Intel 8255 programmable peripheral interface (PPI) chips represented by **75**, an eight bit transceiver **76**, a four bit magnitude comparator **77** and a four pole DIP switch **78**. Switch **78** is used to set the select address of the particular TCC. For example, the first TCC would have all four poles of the switch arranged so that each outputs a logic "0." The switch outputs are connected to one side of the magnitude comparator, and the other side of the comparator is coupled to four board select lines **79** coupled to multiplexer **42**. When comparator **77** sees a match in its two inputted values, it generates a match signal that is inputted via a serial input data (SID) line **80** to the CPU of FIG. **4A** alerting it that the TCC board is being offered the opportunity by multiplexer **42** to output data.

The I/O control logic part of circuit **74** handles the outputting of eight bit parallel data sent to multiplexer **42**. In order to transfer data from TCC **40** to multiplexer **42**, a check is made to ensure that multiplexer **42** is ready to receive a data byte. Then transceiver **76** (FIG. **4B**) is enabled by the one of PPI chips **75**. The data to be transferred is then written into the same PPI chip. If multiplexer **42** is ready, the data byte is strobed into the multiplexer by performing a write operation. Four bus control lines **81**, **82**, **83** and **84** (CLEAR/RESET, STOP, FULL, WRITE) are used to check if the multiplexer is ready for data and to strobe the data into the multiplexer.

This process can be referred to as part of what is referred to herein as "adaptive window multiplexing" wherein multiplexer **42** addresses in sequence each of several TCCs **40**, any of which may or may not have data to output. However, the time allotted to any one TCC is not fixed, as in conventional multiplexing. For the most part, the time taken by any single TCC **40** depends on how much data, if any, needs to be sent from that TCC **40** to multiplexer **42**, subject to limitations of the memory used for buffering in the multiplexer, as described infra. Referring to FIG. **4C**, multiplexer **42** provides address outputs in sequence. The CPU on each TCC **40** looks for its own address (i.e. the address of its board) being issued by the multiplexer, as indicated by diamond **85**. The CPU will know whether it has any data (stored temporarily in RAM) to send. If there is such data, then when the CPU sees its address issue, it will stop multiplexer **42** from progressing to the address of the next TCC in sequence by bringing the STOP line **82** low, indicated by block **86**. A short time later (interposed for example by the execution of a few instructions), the CPU ON TCC **40** checks to make sure that the address at which multiplexer **42** did stop is indeed the address of this particular TCC **40** (diamond **87**). If so, then the CPU will cause a fast data transfer (at a rate of 56K bytes/sec) to the multiplexer (block **88**, **89**, **90**). If the address is wrong, then the CPU will release STOP line **82**, and thereby multiplexer **42**, and not send data (block **91**). This is a double check to ensure that only one TCC **40** sends data to the multiplexer **42** connected to bus **44**. In FIG. **4B**, bus **44** comprises lines **79** and **81** to **84**.

As stated, each TCC **40** has circuitry **74** not included in any of the TCUs **20**. While each TCC **40** uses different software than the TCUs, both the TCU and the TCC program is stored in the 16K×8 EPROM, and the 4K×8 RAM is used to buffer data, for stack purposes and for program use. The RAM has a portion which is used as an input buffer and another portion used as an output buffer. A flow chart of the software used in the TCC of FIG. **4A** is shown in FIG. **5**. A listing of the TCC software is contained in Appendix II.

An important function of each TCC **40** in the preferred embodiment is to convert the ASCII data received from its corresponding TCU **20** into a format more readily usable by the system controller **46**, which preferably is a Hewlett-Packard HP-1000 computer. The conversion occurs at block **94** of FIG. **5**. The last three digits of the originating phone number (LLL in Table II) are converted into a ten bit binary number. The first four originating digits (CCCC in Table II) are converted into a fourteen bit binary number. The area code of the originating phone number is converted into a two bit binary number (it being assumed that no more than four area code regions are covered by the several telephone central offices which serve the subscribers of the cable operator). The numbers entered by the cable subscriber (DDDD in Table II) representing the cable event and the password are converted into binary coded decimal (BCD) values.

The following example illustrates the novel conversion of a three digit ASCII number to a ten bit binary number. In this example "h" following a number indicates that hexadecimal base is used and "d" indicates that the number is a decimal number. The number to be converted is 0110100 (34h) 0110011 (33h) 0110010 (32h), i.e. 432d. The least significant ASCII digit (i.e., the decimal "2" in the "ones" decimal column) is converted into its binary equivalent by subtracting 30h from the digit: 32−30=02h. The second ASCII digit (the next most significant digit, i.e. the "3" in the "tens" column) is then converted to binary with tens-place weighting. This is converted to binary as in the previous conversion, i.e. 33h−30h=03h. Then the base address of a look-up table stored in an EPROM in TCC **40** for the tens units is added to this value in order to find an address in the look-up table. Then, using this address, a value is obtained from the look-up table. For the number 03h in the tens place, the value read from the look-up table is 1Eh (30d). This is a weighted conversion

process. The same weighted conversion process is used for the third ASCII digit, but with different weighting. For 04h (34h−30h) in the hundreds place, the look-up table value is 190h (400d). The hexadecimal values are then combined: 190h+1Eh+02h=1BOh (432d). The conversion process for a four digit ASCII number is similar to the process explained above except, of course, thousands-place weighting is also used.

The following is an example of a conversion of a three digit ASCII value area code to a two bit binary number. In this example "b" following a number indicates that the number is in binary, and again "h" indicates hexadecimal. The area code to be converted is 33 31 32, i.e. 312d. The first ASCII digit is converted into a hexadecimal value by subtracting 30h (32h−30h=02h=000000010b). The second digit is converted in the same manner (31h−30h=01h=00000001b) and this value is rotated left four places (0000001b→00010000b). The first and second values are then combined, and stored in a register of the CPU of the TCC **40** (000000010b+00010000b=00010010b=12h). The third ASCII digit is converted into a hexadecimal value to which the look-up table base address (F0h) is added (33h=30h=03h; 03h+F0h=F3h). The sum value is stored in a CPU register. The first and second register pair (F312h) contains the address where the desired two bit value is found corresponding to the 312 area code.

After the ASCII numbers are converted into the appropriate form, they are stored (block **95** of FIG. **5**) in the output buffer portion of the on-board RAM of TCC **40** until multiplexer **42** indicates that it is ready to receive data (indicated at **96**). In addition, the data to be sent to the multiplexer is arranged in a particular format by the TCC **40** before it is transferred. This is done so that when the data is eventually sent to system controller **46**, it will be able to process the data without excessive manipulation. The format of the data sent to multiplexer **42** is shown in Table IV. As can be seen, the data is transferred (block **97**) in eight bytes, each byte having eight bits. Note that byte **1** contains the two bit binary area code data as well as the first six binary bits of the converted last four digits of the originating phone number. Note also that zeros are inserted into a portion of byte **3** and in all eight bits of bytes **5** and **7**.

TABLE IV

	Data Sent To The Multiplexer From the TCC
BYTE 1:	[(2-bit area code) (1st 6-bits of CCCC)]
BYTE 2:	[remaining 8-bits of CCCC]
BYTE 3:	[000000 (1st 2-bits of LLL)]
BYTE 4:	[remaining 8-bits of LLL]
BYTE 5:	[00000000]
BYTE 6:	[8-bit event #]
BYTE 7:	[00000000]
BYTE 8:	[8-bit user pass word]

C = One of the first 4 digits of subscriber's telephone number (now binary)
L = One of the last 3 digits of subscriber's telephone number (now binary)

Several steps are taken in each TCC **40** to ensure the reliability of data. The system overwrites (block **98**) any data which is retransmitted (which can occur when a negative acknowledgment issues) (decided at diamond **99**). This avoids excessive data. Note also that in this flow chart, if TCC **40** determines that data is to be received from its TCU **20** (diamond **100**) then the TCC will postpone a data transfer, even if data is in the output buffer (decided at diamond **101**). Thus, inputting has priority over outputting, to ensure against losing data. The rationale is that inputted data and data ready for outputting can both be buffered. The data transfer rate on outputting is so high (illustratively 56K bytes/sec) that some delays can be tolerated to allow for inputting.

A block diagram of the preferred embodiment of multiplexer **42** is shown in FIG. **6A**. The multiplexer performs three major functions, namely: (1) selecting one of the sixteen possible TCCs to receive data from at any given time, (2) buffering the received data until system controller **46** is ready to receive it, and (3) transferring the buffered data to the system controller.

Multiplexer **42** illustratively comprises two Mostek 4501 first-in, first-out (FIFO) dual port memory chips **102, 103**, bus interface control and buffer load logic **104**, oscillator and select logic **106**, reset circuitry **108**, input-/output control logic **110** and two output buffers **112** and **114**. Data is received from TCC **40** on an eight bit data bus **116** and transmitted to the system controller **46** on a sixteen bit data bus **118**.

The oscillator and select logic **106**, illustrated further in FIG. **6B**, selects which one of the TCC units **40** data is to be received from. This oscillator circuitry may comprise a schmitt-trigger inverter with its output looped back to is input through a low-pass filter to form an 8 KHz oscillator **120** (FIG. **6B**). This clock signal is used to perform dummy read operations during a system controller request for reset and to increment a board select counter. The board select counter of circuit **106** is illustratively a four bit binary counter **121** with its Enable control coupled to a single stop line **82** which in turn is coupled to all sixteen of the TCC units **40**. Counter **121** continually cycles from 0 to 15 until halted by any of the TCC **40** requesting a data transfer by taking stop line **82** low. Once the data transfer is completed (i.e., the output buffer portion of the RAM in the TCC of the addressed TCC has been emptied), stop line **82** is returned high by such TCC **40**, and counter **121** is allowed to resume its counting in order to address the next TCC in sequence. As shown in FIG. **5**, if there is no data in the output buffer of the addressed TCC (decision diamond **101**), then such TCC will not seize the opportunity to write data onto the eight bit bus **116** (FIG. **6**) coupled to multiplexer **42**. Instead, such TCC **40** will continue receiving and processing synchronously sent packets of data from its TCU **20** and will permit multiplexer **42** to address the next TCC **40** in sequence. Thus, the length of time or the window during which data is received by the multiplexer from a particular TCC adapts according to the amount of data in the TCC output buffer available at the time for transfer, as part of the adaptive window multiplexing technique.

Bus interface control and buffer load logic **104** is responsible for strobing data from a TCC **40** into the correct FIFO buffer **102** or **103**. This circuitry is illustrated in FIG. **6C** and inserts all of the odd number bytes, i.e. bytes **1, 3, 5** and **7** received from a TCC **40** into FIFO **102** and all of the even number bytes, i.e. bytes **2, 4, 6** and **8** into FIFO **103**.

A flow diagran for multiplexer **42** describing the input of the data from the TCCs is shown in FIG. **7**. As counter **121** increments, its output is sent on a four line bus (A0, A1, A2, A3 of FIG. **6B**), as indicated at block **130** of FIG. **7**. Multiplexer **42** then determines whether STOP line **82** has been brought low, at decision diamond **131**, for a requested data transfer. If so, counter **121** is stopped (block **132**; see also the logic circuit **133** coupled to the Enable input of counter **121** in

FIG. 6B). Data is then written into FIFOs 102, 103 (block 134 in FIG. 7), and counting is resumed (block 135).

The outputting of data from multiplexer 42 is shown in the flow diagram of FIG. 8. This includes determining whether multiplexer 42 has any temporarily stored data ready for outputting (diamond 136). Also a determination is made as to whether system controller 46 is ready for a transfer (diamond 137).

It should be noted that the inputting of data to multiplexer 42 is completely independent of the outputting of data from the multiplexer to system controller 46. This allows the telephone central office computers 24 and associated TCUs 20 to operate harmoniously with the system controller 46 at the headend station.

Referring again to FIG. 6A, the input/output control logic 110 performs the handshaking between the multiplexer and the system controller. The handshaking process uses four control lines and corresponding signals: an end of message (EOM) signal on a line 139, a device command (DVCMD) on a line 140, a device flag (DVFLG) on a line 141, and a reset signal on a line 142. Data is transferred from multiplexer 42 to system controller 46 on bus 118 in response to the DVCMD signal, meaning that system controller 46 is ready to receive data, and a FIFO empty (FE) line 143 from FIFO 102 indicating that data is available for transfer, i.e., the FIFO is not empty. At that time, a read line 144 to the FIFO is activated as is the DVFLG line 141 to system controller 46. Once three complete words have been transferred to system controller 46, the EOM control line 139 goes high, signalling that the next word to be transferred will be the last word (Word #3).

System controller 46 preferably is an HP-1000 computer, which reads four words at a time. To ensure against loss of data, the reset signal on line 142 (from system controller 46) forces multiplexer 42 to perform dummy reads from FIFO buffers 102, 103 in order to ensure completion of a four packet transfer. The dummy reads are performed until the EOM signal on line 139 is detected at which time the reset circuitry 108 is disabled and normal read operations are resumed.

Multiplexer 42 converts the eight 8-bit bytes received from each TCC 40 into four 2-byte words which are sent to the system controller at a rate of up to 2M bytes/sec. The conversion process is accomplished by combining the data words stored in the odd byte FIFO 102 with the data words stored in the even byte FIFO 103 to produce a single 2 byte (sixteen bit) word. The sixteen bit words are sent to system controller 46 on the bus 118.

FIG. 9 shows the format of the data words sent by multiplexer 42 to controller 46. The first two bits 144 of Word 0 represent the telephone area code of the cable subscriber originating the IPPV call. The area code was converted into the two bit format by a TCC 40. The number CCCC represents the first four digits (excluding the area code) of the cable subscriber's phone number, converted to binary by the TCC. The three Xs shown in Word 0 and the four Xs of Word 1 are used only to indicate the place of the numbers. The number LLL in Word 1 represents the last three digits of the cable subscriber's phone number, but in binary form. The event 145 and password 146 in Words 2 and 3, respectively, are the numbers entered by the cable subscriber to select a particular cable event. These numbers were converted to BCD (binary coded decimal) by the TCC 40 which processed the data.

By comparing the data format in FIG. 9 with Table IV, it can be seen that Word 0 sent from the multiplexer 42 to the system controller 46 is made up of bytes 1 and 2 sent to the multiplexer from TCC 40. Likewise, Word 1 is made from bytes 3 and 4, Word 2 is made from bytes 5 and 6, and Word 3 is made from bytes 7 and 8. The data sent to system controller 46 is sent in the format shown in FIG. 9 so that the system controller can process the information without extra manipulation. This speeds up the rate at which a cable subscriber's one-way addressable converter is authorized after the subscriber places an IPPV call.

System controller 46 processes the four sixteen bit words of FIG. 9 to identify the cable subscriber, find the subscriber's decoder address, and change the decoder authorization to allow viewing of the program selected by the subscriber (or to implement a cancellation at the subscriber's request). The system controller also initiates proper billing of the transaction by sending information to billing computer 50.

The four words sent to the system controller are sent directly to the buffer memory of the controller using direct memory access (DMA). In order to process the data sent to it at the fastest possible rate, system controller 46 employs a phase inverted synchronous input/output process using four buffers, two for input and two for output. FIG. 10 show a diagram of this buffer system. While an input buffer 147 is receiving data from multiplexer 42, an output buffer 148 is outputting data to the cable TV encoder 48 or the billing computer 50. Concurrently, data from an input buffer 149 is being processed and sent to an output buffer 150. These concurrent processes are represented by the solid and broken lines in FIG. 10. When the data in input buffer 149 is exhausted, output buffer 150 receives data from other sources until it becomes filled. During this time, output buffer 148 continues to output data. When buffer 148 no longer has data to output, system controller 46 is interrupted, and the buffer arrangement is inverted. The inputting, outputting and processing after the interrupt is shown by the broken lines in FIG. 10. After the interrupt, data is inputted into input buffer 149; output buffer 150 sends data to cable TV encoder 48 or billing computer 50; and data from input buffer 147 is processed and sent to output buffer 148. This alternating process is continually repeated to ensure that processor 46 does not waste time waiting for data to be inputted or outputted.

As mentioned, system controller 46 processes the four words sent to it by multiplexer 42 to locate ("map") the address of the one-way addressable converter for the cable subscriber initiating the IPPV call, to check the password entered by the cable subscriber and to change the authorization code in the cable subscriber's converter in order to allow him to view the cable event. FIG. 11 is a diagram which should be helpful to understand the processing which occurs at system controller 46, addressable CATV encoder 48 and billing computer 50. Data from multiplexer 42 is applied to one of the input buffers of FIG. 10 which is represented as a buffer 151 in FIG. 11 receiving an input via line 152. The inputs comprise the four words depicted in FIG. 9. These four words are used to determine the action which is to occur. Words 0, 1 and 3 are used to map the telephone number of the subscriber into the address code of his converter, as shown at 154. Referring back to FIG. 9, it will be seen that Word 0 comprises the area code and part of the telephone number of the sub-

scriber, and Word 1 completes the telephone number of the subscriber. At 154, system controller 46 finishes mapping the telephone number to the unique address code of the converter of the cable subscriber. Word 3 is used to make sure that the password is valid or, alternatively, to determine which of several converters are to be authorized at the premises of the cable subscriber. In this mapping function, system controller 46 refers to a data base 156, discussed infra. In the event that system controller 46 cannot map the telephone number into a converter code (because, for example, of a wrongfully dialed telephone number), an error is generated at 158. That error can also be generated if the data base reflects the unavailability of the event for purchase by that particular subscriber, because of bad credit, tardy bill payments, or whatever reasons are considered to be adequate by the cable company.

Word 2 of FIG. 9 identifies the cable event which the cable subscriber wishes to purchase or to cancel. Word 2 is applied at 160 to determine the action which is requested by the subscriber. The system provides for the subscriber to either request a pay per view cable event or, if he wishes, to cancel it within a prescribed time. Referring to a schedule 162, the determination is made as to whether the cable event is requested to be turned on or off. If no such cable event is found in the schedule 162, an error 164 will be generated. Assuming that there are no errors in the determinations 154 or 160, then an authorization to program the cable subscriber's converter as well as a program tag and a program identification are provided to an output 166. From there, the information is provided to an output buffer 168 which holds information until the CATV encoder 48 processes it.

In addition, from the output 166 information including the converter indentification, the program identification, and a timestamp are posted to a disk at 170 within system controller 46. Subsequently, these postings are unloaded to billing computer 50, typically on the next business day. Billing computer 50 had editing capabilities via a line 172 with data base 156. Thus, if desired by the cable company, the billing computer can edit the data base so that no cable subscriber can exceed some limitation per month on cable pay per view events. Also, the system can provide in this manner for preventing any pay per view events from being purchased by a cable subscriber while permitting normal cable operation. This will be determined by the policy of the cable company, but the present system provides the flexibility to achieve all objectives of the cable company. FIG. 12 further illustrates the mapping process occurring in system controller 46. To map the telephone number of the subscriber into an authorization code, system controller 46 preferably uses a two level tree having a root and many leaves. In the preferred system, a root corresponds to one page of memory (which is 1024 words, each 16 bits) and each leaf also is one page of memory. The root uses table searching. Thus, in FIG. 12, Word 0 is used to search the root at 180. The root usually has between 10 and 50 entries, which corresponds to the fact that the first four digits of a seven digit telephone number used by the telephone company occur in selected groups. In other words, there is a limitation used by the telephone company so that although four digits are used, there are fewer than 10,000 numbers which are actually assigned, although 10,000 are theoretically possible. This root is sometimes referred to as the PHIN root, standing for "phone index." In the event that the searching at 180 does not locate the number which has been specifiifed by Word 0, than an error is indicated as shown at 182. However, if the root is found at 180, then Word 1 is used to search the leaf at 184. The leaf has many parts, the Word 1 is used to arrive at a correct pointer stored in the leaf. This method is referred to as direct indexing by persons skilled in the art, and is a time efficient method. The pointer will lead to the correct information for the converter of the cable subscriber who telephoned his request. In the event that the direct indexing does not locate the pointer, then an error is indicated at 186. If the pointer is found, then Word 3 is used to check the password at 188. If the password matches, then authorization can be provided at 190. If, however, the password does not match, then an error will issue at 192.

FIG. 13 illustrates the processing of the four words of FIG. 9 more particularly. Word 0 at block 200, containing the two bit area code and the fourteen bit number group corresponding to the first four digits of the cable subscriber's telephone number, is used to locate within a phone index (PHIN) root 202 one of several leaves 204. Word 1 at block 206 containing the ten bits corresponding to the last three digits of the cable subscriber's telephone number is used to find the particular slot in the phone index leaf 204 containing a pointer to the unique data of interest. This points to a block 208 which contains the home unit control block (HUCB) comprising the cable subscriber's one-way addressable converter address, the current authorization code for the cable subscriber, a password and an IPPV flag. The password is then read from the home unit control block and compared at block 210 with the password contained in Word 3 which is represented by block 212. If the two passwords match, the home unit control block authorization bits are then updated at block 214 with the event number contained in Word 2 (in block 216). The new home unit control block information is then sent out to the cable subscriber's converter so that the converter will be enabled, thus allowing the viewer to view the program selected by the IPPV call. System controller 46 also downloads the necessary information to billing computer 50 so that the cable subscriber will be billed for the IPPV event.

Thus, it will be appreciated that at the cable headend station, data from multiple telephone offices are gathered, mapped into addresses and converter authorization codes (provided no errors are found), posted for billing purposes, and encoded for nearly instant updating. The mapping for each request preferably occurs in more than one step at plural locations, so the burden on the system controller is eased. As described herein, each TCC 40 converts ASCII characters for received phone numbers into binary data, and converts the ASCII characters identifying the PPV event to be purchased as well as the password into BCD. At the system controller, these data are mapped fully into converter addresses and program tags.

By the system of the present invention, there is provided a system for accepting impulses purchases from cable subscribers who do not have two-way cable TV systems. The described system is compatible with ANI passing, and accepts information provided by the telephone office ANI computer as fast as the computer can supply it. The data is automatically translated into a form usable by the system controller and communicated at a fast rate. Appropriate error checking occurs along the entire stream of data flow to ensure reliability. The

requests of the cable subscribers are checked in real time, and barring any reason to forbear, the cable subscriber's cable TV addressable converter is authorized to allow the subscriber to view or cancel the cable event as desired. After the cable event is completed, the system controller clears the data base of the authorizations.

It will be appreciated from the foregoing discussion that the device at the subscriber premises, which has been variously described as a "converter," "converter box," or "decoder," and which has been said to be able to descramble signals, may generally be referred to as an "access terminal unit."

It will be apparent that numerous modifications can be made within the scope of the present invention. The arrangement described herein is illustrative, and the scope of protection is indicated by reference to the following claims.

```
LOC  OBJ        LINE       SOURCE STATEMENT

                    1 ;;;
```

```
4FB7                    48 TIME    EQU     4FB7H          ;TIME OUT COUNTER
E000                    49 RESET   EQU     0E000H         ;WATCH DOG RESET CIRCUIT ADDRESS
                        50         ;
                        51         ;
                        52 ;;;
```

```
0075 3E09       105         MVI     A,09H           ;ENABLE 7.5 AND 6.5
0077 30         106         SIM
0078 21A74F     107         LXI     H,XMIT          ;PREPARE TO TURN-ON TRANSMITTER
007B CD3903     108         CALL    CMDOUT          ;OUTPUT COMMANDS
007E FB         109 MLOOP:  EI
007F 3200E0     110         STA     RESET           ;HIT RESET CIRCUIT
0082 00         111         NOP
0083 C37E00     112         JMP     MLOOP           ;IF NOT, KEEP LOOPING
0086 21FFFF     113 ACKLOP: LXI     H,0FFFFH        ;SET-UP TIME-OUT COUNTER FOR 24MS
0089 22B74F     114         SHLD    TIME
008C 2AB74F     115 ACKLP2: LHLD    TIME            ;GET CURRENT TIME-OUT COUNT
008F 2B         116         DCX     H               ;DECREMENT THAT VLAUE
0090 22B74F     117         SHLD    TIME            ;STORE NEW VALUE
0093 7C         118         MOV     A,H
0094 A7         119         ANA     A               ;SEE IF COUNT IS EQUAL TO ZERO
0095 CAA200     120         JZ      NOACK           ;IF COUNT IS ZERO, NO ACK.
0098 FB         121         EI
0099 3200E0     122         STA     RESET
009C 00         123         NOP
009D 00         124         NOP
009E F3         125         DI
009F C38C00     126         JMP     ACKLP2
00A2 F3         127 NOACK:  DI
00A3 2AA04F     128         LHLD    POINTO          ;TREAT NO ACK. AS A NACK
00A6 22B34F     129         SHLD    CURRENT         ;RESET POINTER TO RETRANSMIT
00A9 216803     130         LXI     H,DR            ;PREPARE TO DISABLE RECEIVER
00AC CD3903     131         CALL    CMDOUT
00AF 3E09       132         MVI     A,09H           ;ENABLE 7.5 AND 6.5
00B1 30         133         SIM
00B2 FB         134         EI                      ;ENABLE INTERRUPTS
00B3 00         135         NOP
00B4 3200E0     136         STA     RESET           ;WAST TIME TO SEE IF DATA IS AVAILABLE
00B7 C37400     137         JMP     TXSTRT          ;BEGIN RETRANSMISSION
                138         ;
00BA F3         139 INLOOP: DI
00BB 3AAD4F     140         LDA     PACKET          ;GET PACKET COUNT
00BE A7         141         ANA     A               ;IS THERE A COMPLETE PACKET IN RAM
00BF C27400     142         JNZ     TXSTRT          ;IF SO, BEGIN TRANSMISSION
00C2 FB         143         EI                      ;ELSE WAIT FOR COMPLETE PACKET
00C3 3200E0     144         STA     RESET           ;HIT RESET CIRCUITRY
00C6 00         145         NOP
00C7 C3BA00     146         JMP     INLOOP
                147         ;
                148 ;;;
```

```
00E2 3AA44F      162 HLOOK2: LDA     INCOME          ;GET HEADER COUNTER
00E5 A7          163         ANA     A               ;SEE IF HEADER BYTE
00E6 CAFC00      164         JZ      DLOOK           ;IF NOT, GET DATA
00E9 47          165         MOV     B,A             ;ELSE, PUT COUNT INTO REG. B
00EA 3A0590      166 AGAIN:  LDA     ASTAT           ;GET STATUS FROM 8250
00ED E601        167         ANI     01H             ;MASK TO GET DR FLAG
00EF 3200E0      168         STA     RESET           ;HIT RESET CIRCUITRY
00F2 CAEA00      169         JZ      AGAIN           ;IF NO DATA READY, LOOK AGAIN
                 170         ;
00F5 3A0090      171         LDA     ADATA           ;READ CHARACTER TO RESET DR
00F8 05          172         DCR     B               ;DECREMENT HEADER COUNTER
00F9 C2EA00      173         JNZ     AGAIN
                 174         ;
                 175 ;;;
```

```
0141 FE20       218         CPI     20H             ;IS IT A SPACE
0143 CA7701     219         JZ      RETFLG
0146 320080     220         STA     8000H           ;OUTPUT TO CRT
0149 FE0D       221         CPI     0DH             ;IS IT A CR
014B CA7701     222         JZ      RETFLG
014E FE0A       223         CPI     0AH             ;IS IT A LF
0150 CA5A01     224         JZ      INDONE          ;IF SO, INPUT PACKET COMPLETE
0153 77         225         MOV     M,A             ;ELSE, VALID DATA, STORE IN RAM
0154 23         226         INX     H
0155 22A24F     227         SHLD    POINTI          ;STORE UPDATED INPUT POINTER
0158 F1         228         POP     PSW             ;RESTORE FLAGS
0159 C9         229         RET
015A 3E0C       230 INDONE: MVI     A,0CH           ;RESET HEADER COUNT
015C 32A44F     231         STA     INCOME
015F 3AAD4F     232         LDA     PACKET          ;GET CURRENT PACKET COUNT
0162 FED0       233         CPI     0D0H            ;HAS MAX. PACKET COUNT BEEN REACHED
0164 CA7101     234         JZ      RETRES          ;IF SO, RESET INPUT POINTERS AND RETURN
0167 3C         235         INR     A               ;ELSE, INCREMENT PACKET COUNT
0168 32AD4F     236         STA     PACKET          ;STORE NEW VALUE
016B CD7901     237         CALL    UP13            ;INCREMENT INPUT POINTERS TO NEXT BLOCK
016E C37701     238         JMP     RETFLG          ;RETURN TO MAIN BODY
0171 2AB54F     239 RETRES: LHLD    PTINP           ;GET CURRENT INPUT BASE POINTER
0174 22A24F     240         SHLD    POINTI          ;RESET INPUT POINTER TO OVERWRITE
0177 F1         241 RETFLG: POP     PSW             ;RESTORE CPU STATUS WORD BEFORE RETURNING
0178 C9         242         RET
                243         ;
                244         ;
                245 ;;;
```

```
0196 CAED01      275          JZ      OUTBYT      ;IF NOT, OUTPUT DATA BYTE
0199 3AB24F      276          LDA     STATUS      ;GET PREVIOUSLY READ STATUS BYTE
019C E610        277          ANI     10H         ;IS THERE AN IMMEDIATE RESULT AVAIL.
019E CAA501      278          JZ      CONT        ;IF NOT CONTINUE ON
01A1 3A0160      279          LDA     6001H       ;IF SO, READ RESULT
01A4 C9          280          RET
01A5 3A0260      281 CONT:    LDA     IXIR        ;READ INTERRUPT RESULT BYTE
01A8 FE0D        282          CPI     0DH         ;IS PACKET COMPLETE AND ERROR FREE
01AA C2B601      283          JNZ     BAD         ;IF NOT, GOTO TO BAD
01AD 3E00        284          MVI     A,00H       ;RESET NO ACK. FLAG
01AF 32A64F      285          STA     ACKFLG
01B2 C3C201      286          JMP     STATLP      ;CHECK AGAIN
01B5 00          287          NOP                 ;TURN RECEIVER ON AT THIS POINT
01B6 3EFF        288 BAD:     MVI     A,0FFH      ;SET NO ACK FLAG
01B8 32A64F      289          STA     ACKFLG
01BB 2AA04F      290          LHLD    POINTO      ;LOAD ORIGINAL OUTPUT POINTER
01BE 22B34F      291          SHLD    CURRENT     ;STORE IN CURRENT OUTPUT POINTER LOC.
01C1 00          292          NOP                 ;SINCE PACKET IS BAD, PREPARE TO RETRANS.
01C2 3A0060      293 STATLP:  LDA     SSTAT       ;GET STATUS BYTE TO CHECK FOR RESULTS
01C5 E601        294          ANI     01H         ;ARE THERE ANY MORE RESULTS AVAILABLE
01C7 CAD001      295          JZ      TURNON      ;IF NO RESULTS, RETURN (RZ)
01CA 3A0260      296          LDA     IXIR        ;READ INTERRUPT RESULT BYTE
01CD C3C201      297          JMP     STATLP      ;CHECK FOR MORE RESULT BYTES
01D0 3AA64F      298 TURNON:  LDA     ACKFLG      ;GET ACK FLAG
01D3 A7          299          ANA     A           ;IS AN ACK EXPECTED
01D4 CADC01      300          JZ      RXON        ;IF SO, PREPARE TO TURN ON RECEIVER
01D7 217400      301 TXON:    LXI     H,TXSTAT    ;LOAD HL WITH RETURN ADDRESS
01DA E3          302          XTHL                ;PUT ON TOP OF STACK
01DB C9          303          RET
01DC 218600      304 RXON:    LXI     H,ACKLOP    ;PUT ACKLOP PROGRAM LOCATION INTO HL
01DF E3          305          XTHL                ;REPLACE WITH TOP OF STACK
01E0 3E0A        306          MVI     A,0AH       ;SET INTR. MASK TO RECEIVE
01E2 30          307          SIM
01E3 216A03      308          LXI     H,RCV       ;TURN-ON RECEIVER
01E6 CD3903      309          CALL    CMDOUT      ;OUTPUT TURN-ON COMMANDS
01E9 01B90A      310          LXI     B,0AB9H     ;SET-UP TIME-OUT COUNTER, 24MS WAIT
01EC C9          311          RET
01ED 2AB34F      312 OUTBYT:  LHLD    CURRENT     ;GET CURRENT OUTPUT DATA POINTER
01F0 7E          313          MOV     A,M         ;PUT DATA BYTE INTO A
01F1 320070      314          STA     SDATAO      ;OUTPUT DATA TO 8273
01F4 23          315          INX     H
01F5 22B34F      316          SHLD    CURRENT     ;STORE UPDATED OUPUT POINTER
01F8 C9          317          RET
                 318          ;
                 319 ;;;
```

```
                    332                             ;OF RAM
0204 C9             333         RET
                    334         ;
                    335         ;
                    336 ;;;
```

```
026E 30          389         SIM
026F 01B90A      390         LXI     B,0AB9H         ;RESET TIME-OUT COUNTER
0272 C9          391         RET                     ;CONTINUE LOOKING FOR ACK.
0273 3AB04F      392 GOODTA: LDA     ACKBYT          ;GET ACK. BYTE
0276 FEA5        393         CPI     0A5H            ;WAS IT A POSITIVE ACKNOWLEDGEMNET
0278 C24E02      394         JNZ     BADR            ;IF NOT, SET-UP FOR RETRANSMISSION
027B 2AB34F      395         LHLD    CURRENT         ;GET CURRENT OUTPUT POINTER
027E CDF901      396         CALL    OVERFL          ;INSURE POINTER IS WITHIN RANGE
0281 22B34F      397         SHLD    CURRENT
0284 22A04F      398         SHLD    POINTO          ;STORE UPDATED POINTERS
0287 3AAC4F      399         LDA     ID              ;GET CURRENT PACKET ID NUMBER
028A 3C          400         INR     A               ;INCREMENT ID NUMBER FOR NEXT TRANSMISSION
028B 32AC4F      401         STA     ID              ;STORE NEW ID NUMBER
028E 3AAD4F      402         LDA     PACKET          ;GET CURRENT PACKET COUNT
0291 3D          403         DCR     A               ;DECREMENT THAT VALUE
0292 32AD4F      404         STA     PACKET          ;STORE NEW VALUE
0295 CAC402      405         JZ      EMPTY           ;IF PACKET COUNT=0, BUFFER IS EMPTY
                 406         ;
0298 216803      407 RSTAT:  LXI     H,DR            ;TURN-OFF RECEIVER
029B CD3903      408         CALL    CMDOUT
029E 3E09        409         MVI     A,09H           ;SET INTERRUPT MASK FOR TRANSMISSION
02A0 30          410         SIM
02A1 217400      411         LXI     H,TXSTRT        ;LOAD HL WITH RECEIVER TURN-ON COMMAND LINE
02A4 E3          412         XTHL                    ;REPLACE THAT ADDRESS WITH STACK
02A5 3A0060      413 RSTATL: LDA     SSTAT           ;READ STATUS
02A8 E602        414         ANI     02H             ;ANY RXIR AVAILABLE
02AA C8          415         RZ                      ;IF NO RESLUTS, RETURN
02AB 3A0360      416         LDA     RXIR            ;ELSE, READ INTERRUPT RESULT
02AE C3A502      417         JMP     RSTATL          ;CHECK TO SEE IF ANY MORE RESULTS EXIST
                 418         ;
02B1 2AB34F      419 INBYTE: LHLD    CURRENT         ;GET CURRENT INPUT POINTER
02B4 3A00B0      420         LDA     SDATAI          ;GET INPUT DATA BYTE
02B7 32B04F      421         STA     ACKBYT          ;STORE ACKNOWLEDGEMENT BYTE
02BA 01B90A      422         LXI     B,0AB9H         ;RESTORE TIME-OUT COUNTER, 24MS
02BD 3EAA        423         MVI     A,0AAH          ;PUT 0AAH IN ACKFLG TO SHOW DATA RECEIVED
02BF 32A64F      424         STA     ACKFLG
02C2 A7          425         ANA     A               ;RESET ZERO FLAG IN CPU STATUS WORD
02C3 C9          426         RET
                 427         ;
02C4 216803      428 EMPTY:  LXI     H,DR            ;DISABLE RECEIVER
02C7 CD3903      429         CALL    CMDOUT
02CA 3E08        430         MVI     A,08H           ;SET INTERRUPT MASK, ENABLE 7.5
02CC 30          431         SIM
02CD 21BA00      432         LXI     H,INLOOP        ;SINCE RAM IS EMPTY, GET A COMPLETE PACKET
02D0 E3          433         XTHL
02D1 C3A502      434         JMP     RSTATL
                 435         ;
                 436         ;
                 437 ;;;
```

```
02DB 320090      445         STA     BAUDLS          ;4FH FOR 6MHZ CRYSTAL
02DE 3E00        446         MVI     A,00H           ;MSB OF DIVISOR
02E0 320190      447         STA     BAUDMS
02E3 3E07        448         MVI     A,07            ;8-BITS, NO PARITY, 2 STOP BITS
02E5 320390      449         STA     LCR             ;SET-UP OPERATING CONDITIONS
02E8 3E00        450         MVI     A,00H
02EA 320590      451         STA     ASTAT           ;CLEAR LINE STATUS REGISTER
02ED 3E01        452         MVI     A,01H           ;ENABLE DATA AVAILABLE INTERRUPT
02EF 320190      453         STA     DISINR          ;INTERRUPT ENABLE REGISTER
02F2 3E0F        454         MVI     A,0FH           ;ACTIVATE MODEM CONTROL LINES
02F4 320490      455         STA     LCR+1
02F7 C9          456         RET
                 457 ;
                 458 ;
02F8 215C03      459 I8273:  LXI     H,OPMODES
02FB CD3903      460         CALL    CMDOUT
02FE 215F03      461         LXI     H,SMODES
0301 CD3903      462         CALL    CMDOUT
0304 216203      463         LXI     H,DTAXS
0307 CD3903      464         CALL    CMDOUT
030A 216503      465         LXI     H,BITS
030D CD3903      466         CALL    CMDOUT
0310 216A03      467         LXI     H,RCV
0313 CD3903      468         CALL    CMDOUT
0316 C9          469         RET
                 470 ;
                 471 ;
0317 3E80        472 I82502: MVI     A,80H           ;SET-UP TO LOAD BAUD DIVISOR
0319 320380      473         STA     8003H           ;WRITE TO LCR, SET DLAB=1
031C 3E68        474         MVI     A,68H           ;LSB OF DIVISOR, 8MHZ CRYSTAL
031E 320080      475         STA     8000H           ;4FH FOR 6MHZ CRYSTAL
0321 3E00        476         MVI     A,00H           ;MSB OF DIVISOR
0323 320180      477         STA     8001H
0326 3E07        478         MVI     A,07            ;8-BITS, NO PARITY, 2 STOP BITS
0328 320380      479         STA     8003H           ;SET-UP OPERATING CONDITIONS
032B 3E00        480         MVI     A,00H
032D 320180      481         STA     8001H           ;CLEAR LINE STATUS REGISTER
0330 320580      482         STA     8005H           ;DISABLE INTERRUPTS
0333 3E0F        483         MVI     A,0FH
0335 320480      484         STA     8004H
0338 C9          485         RET
                 486 ;
0339 0E30        487 CMDOUT: MVI     C,30H
033B 46          488         MOV     B,M
033C 23          489         INX     H
033D 3A0060      490 CMD1:   LDA     SSTAT
0340 07          491         RLC
0341 DA3D03      492         JC      CMD1
0344 7E          493         MOV     A,M
0345 320060      494         STA     SCMDRG
0348 78          495 CMD2:   MOV     A,B
0349 A7          496         ANA     A
034A C8          497         RZ
034B 23          498         INX     H
034C 05          499         DCR     B
034D 3A0060      500 CMD3:   LDA     SSTAT
0350 E620        501         ANI     20H
```

```
0352 C24D03      502         JNZ     CMD3
0355 7E          503         MOV     A,M
0356 320160      504         STA     SPRMRG
0359 C34803      505         JMP     CMD2
                 506 ;
                 507 ;
035C 01          508 OPMODES:        DB      01,91H,00000111B
035D 91
035E 07
035F 01          509 SMODES:         DB      01,0A0H,00000000B
0360 A0
0361 00
0362 01          510 DTAXS:          DB      01,97H,00000001B
0363 97
0364 01
0365 01          511 BITS:           DB      01,0A4H,00000000B
0366 A4
0367 00
0368 00          512 DR:             DB      00,0C5H
0369 C5
036A 02          513 RCV:            DB      02,0C0H,01H,00H
036B C0
036C 01
036D 00
                 514 ;
                 515 ;
                 516 ;
036E 3E04        517 IXMIT:  MVI     A,04H           ;FOUR PARAMETERS IN COMMAND
0370 32A74F      518         STA     XMIT            ;STORE IN RAM
0373 3EC8        519         MVI     A,0C8H          ;GENERAL TRANSMIT COMMAND
0375 32A84F      520         STA     XMIT+1
0378 3E13        521         MVI     A,13H           ;LSB OF PACKET LENGTH
037A 32A94F      522         STA     XMIT+2
037D 3E00        523         MVI     A,00H           ;MSB OF PACKET LENGTH
037F 32AA4F      524         STA     XMIT+3
0382 3EFF        525         MVI     A,0FFH          ;ADDRESS BYTE TO BE SENT
0384 32AB4F      526         STA     XMIT+4
0387 C9          527         RET
                 528 ;
                 529         END
```

USER SYMBOLS

ACKBYT	A 4FB0	ACKFLG	A 4FA6	ACKLOP	A 0086	ACKLP2	A 008C	ADATA	A 9000	AGAIN	A 00EA	ASTAT	A 9005
BAD	A 01B6	BADR	A 024E	BAUDLS	A 9000	BAUDMS	A 9001	BEGIN	A 0040	BITS	A 0365	BUFFER	A 4000
CMD1	A 033D	CMD2	A 0348	CMD3	A 034D	CMDOUT	A 0339	CNTRL	A 4FAC	CONT	A 01A5	CONTR	A 0222
COUNTS	A FF0C	CRTBUF	A 4FB1	CURREN	A 4FB3	DATAIN	A 011F	DATCRC	A 0264	DIN	A 013E	DISINR	A 9001
DLOOK	A 00FC	DR	A 0368	DTAXS	A 0362	EMPTY	A 02C4	GETACK	A 0205	GOODR	A 022F	GOODTX	A 0273
HLOOK	A 00CA	HLOOK2	A 00E2	I82501	A 02D4	I82502	A 0317	I8273	A 02F8	ID	A 4FAC	INBYTE	A 02B1
INCOME	A 4FA4	INDONE	A 015A	INLOOP	A 008A	INP	A 0107	INPUTD	A 012E	IXMIT	A 036E	LCR	A 9003
MAIN	A 005C	MLOOP	A 007E	NOACK	A 00A2	OPMODE	A 035C	OUTBYT	A 01ED	OUTDAT	A 018E	OVERFL	A 01F9
PACKET	A 4FAD	POINTI	A 4FA2	POINTO	A 4FA0	PTINP	A 4FB5	RAM	A 4000	RCV	A 036A	RESET	A E000
RESULT	A 6001	RETFLG	A 0177	RETRES	A 0171	RL1	A 0231	RL2	A 0237	RSTAT	A 0298	RSTATL	A 02A5
RXCALL	A 025C	RXIR	A 6003	RXON	A 01DC	SCMDRG	A 6000	SDATAI	A B000	SDATAO	A 7000	SMODES	A 035F
SPRMRG	A 6001	SSTAT	A 6000	STATLP	A 01C2	STATUS	A 4FB2	TIME	A 4FB7	TURNON	A 01D0	TXIR	A 6002
TXON	A 01D7	TXSTAT	A 4FA5	TXSTRT	A 0074	UP13	A 0179	XMIT	A 4FA7				

ASSEMBLY COMPLETE, NO ERRORS

APPENDIX II

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1        MODULE   PAGE    1


   LOC  OBJ        LINE       SOURCE STATEMENT

                     1 ;;;
```

```
4FAD            50 PACKET  EQU     POINTIZ+11      ;PACKETS REMAINING IN RAM
4FB7            51 GETID   EQU     4FB7H           ;INPUT DATA COUNTER, USED FOR GETTING ID
4FB6            52 CRTBUF  EQU     4FB6H           ;DATA HERE IS OUTPUT TO CRT
4FB5            53 STATUS  EQU     4FB5H           ;STATUS BYTE READ FROM 8273
4FB3            54 CURRENT EQU     4FB3H           ;CURRENT OUTPUT POINTER (ALSO 4FB4H)
E000            55 RESET   EQU     0E000H          ;WATCH DOG RESET CIRCUIT ADDRESS
                56         ;
00F0            57 AREA    EQU     0F0H            ;MSB BASE OF AREA CODE LOOK-UP TABLE
                58                                 ;THIS VALUE SHOULD BE 10H FOR PROTO-TYPE USE
                59                                 ;AND F0H FOR PRODUCTION USE.
4026            60 TOPOUT  EQU     4026H           ;STARTING ADDRESS OF OUTPUT BUFFER
4F8A            61 CNVRTP  EQU     4F8AH           ;LOCATION TO STORE CONVERTER POINTER
4F8C            62 TXFLG   EQU     4F8CH           ;LOCATION OF OUTPUT BUFFER READY FLAG
4F8D            63 DATAVA  EQU     4F8DH           ;FLAG TO DETERMINE WHETHER DATA IS AVA. FOR CK.
4F8E            64 SAMPAC  EQU     4F8EH           ;LOCATION WHICH HOLD REPEAT PACKET COUNT
4F8B            65 CNVRTH  EQU     CNVRTP+1        ;THIS LOCATION CONTAINS THE H REG.
4F90            66 HPCNVT  EQU     4F90H           ;BASE POINTER FOR DATA CONVERSION
4F92            67 HPSAVE  EQU     HPCNVT+2        ;OFFSET DATA CONVERSION POINTER
4F94            68 BYTE12  EQU     HPCNVT+4        ;HP OUTPUT, BYTES 1 AND 2
4F96            69 BYTE34  EQU     HPCNVT+6        ;BYTES 3 AND 4
4F98            70 BYTE56  EQU     HPCNVT+8        ;BYTES 5 AND 6
4F9A            71 BYTE78  EQU     HPCNVT+0AH      ;BYTES 7 AND 8
4F9C            72 VALUE   EQU     HPCNVT+0CH      ;LOCATION WHERE MULTIPLIED VALUE IS SAVED
4F9E            73 CNVBUF  EQU     HPCNVT+0EH      ;CONVERTER BUFFER FULL FLAG LOCATION
00FF            74 MUXRUN  EQU     0FFH            ;MUX COUNTER RUNNING AND NO RESET
001F            75 MRESET  EQU     1FH             ;RESET SIGNAL FOR THE MUX BOARD
002F            76 MSTOP   EQU     2FH             ;MUX STOP COUNTER SIGNAL
                77         ;
4FBA            78 ADDRES  EQU     4FBAH           ;ACK. PACKET ADDRESS BYTE LOCATION
4FBB            79 ID      EQU     ADDRES+1        ;PACKET ID BYTE LOCATION
4FBC            80 TXBYTE  EQU     ADDRES+2        ;ACKNOWLEDGE BYTE. A5=GOOD. C3=BAD
4FBD            81 TXPNT   EQU     ADDRES+3        ;ACK. OUTPUT BUFFER POINTER
                82         ;
0010            83 PORT4A  EQU     10H             ;IC4, 8255 PORT A
0011            84 PORT4B  EQU     11H             ;IC4, 8255 PORT B
0012            85 PORT4C  EQU     12H             ;IC4, 8255 PORT C
0013            86 CPORT4  EQU     13H             ;IC4, 8255 CONTROL PORT
0020            87 PORT5A  EQU     20H             ;IC5, 8255 PORT A
0023            88 CPORT5  EQU     23H             ;IC5, 8255 CONTROL PORT
D000            89 MUXWR   EQU     0D000H          ;USE THIS ADDRESS TO WRITE TO MUX BOARD
                90         ;
                91         ;
                92 ;;;
```

```
1414                    106         ORG     1414H
1414 FF                 107         DB      11111111B       ;414 AREA CODE
                        108         ;
                        109         ;
                        110 ;;;
```

```
0000            162         ORG     0000H
0000 F3         163         DI
0001 3E1E       164         MVI     A,1EH           ;ENABLE
0003 30         165         SIM                     ;SET INTERRUPT MASK
0004 210040     166         LXI     H,RAM           ;SET ALL POINTERS TO TOP OF RAM
0007 22B34F     167         SHLD    CURRENT
000A 22A24F     168         SHLD    POINTI
000D 22A04F     169         SHLD    POINTO
0010 22904F     170         SHLD    HPCNVT
0013 22924F     171         SHLD    HPSAVE
0016 21BA4F     172         LXI     H,ADDRES
0019 22BD4F     173         SHLD    TXPNT           ;SET ACK. TRANSMIT OUTPUT POINTER
001C 212640     174         LXI     H,TOPOUT
001F 228A4F     175         SHLD    CNVRTP          ;SET-UP OUTPUT BUFFER POINTER
0022 C34000     176         JMP     BEGIN
                177         ;
002C            178         ORG     002CH           ;RST 5.5
002C C30701     179         JMP     INPDAT
                180         ;
0034            181         ORG     0034H           ;RST 6.5
0034 C3ED01     182         JMP     OUTACK
                183         ;
003C            184         ORG     003CH           ;RST 7.5
003C C38102     185         JMP     OUTCRT
                186         ;
0040            187         ORG     0040H           ;BEGINNING OF MAIN PROGRAM
0040 01FFFF     188 BEGIN:  LXI     B,0FFFFH
0043 3200E0     189 TL1:    STA     RESET           ;HIT RESET CIRCUIT
0046 0B         190         DCX     B
0047 78         191         MOV     A,B
0048 A7         192         ANA     A
0049 C24300     193         JNZ     TL1
004C 79         194         MOV     A,C
004D A7         195         ANA     A
004E C24300     196         JNZ     TL1
0051 310050     197 START:  LXI     SP,5000H        ;SET STACK POINTER TO TOP
0054 CD9902     198         CALL    I82501
0057 CDDC02     199         CALL    I82502
005A CDBD02     200         CALL    I8273
005D CD3303     201         CALL    IXMIT           ;SET-UP OUTPUT ARRAY
0060 CD4B03     202         CALL    I8255
0063 3E00       203         MVI     A,00H
0065 32B64F     204         STA     ID              ;STORE PACKET ID
0068 32AD4F     205         STA     PACKET          ;ZERO PACKET COUNT
006B 32B74F     206         STA     GETID           ;RESET DATA COUNTER TO GET ID
006E 329E4F     207         STA     CNVBUF          ;RESET CONVERT BUFFER EMPTY FLAG
0071 32BC4F     208         STA     TXFLG           ;NO DATA READY FOR TRANSFER TO HP
0074 3E0F       209         MVI     A,0FH           ;SET REPEAT PACKET COUNT TO 15
0076 328E4F     210         STA     SAMPAC
0079 3EFF       211         MVI     A,0FFH          ;ADDRESS TO BE SENT IN ALL ACK. PACKETS
007B 32B44F     212         STA     ADDRES
                213         ;
                214 ;;;
```

```
                    218 ;;;
```

```
00EB CDFE02     275         CALL    CMDOUT          ;OUTPUT CAMMANDS
00EE FB         276 TXLOOP: EI
00EF 3200E0     277         STA     RESET
00F2 00         278         NOP
00F3 C3EE00     279         JMP     TXLOOP
                280         ;
                281         ;
                282 ;;;
```

```
013B E3          332          XTHL                    ;SWITCH WITH STACK
013C C34B01      333          JMP     RSTAT           ;GOTO STATUS LOOP
013F 3EA5        334 GOODR:   MVI     A,0A5H          ;POSITIVE ACKNOWLEDGEMENT
0141 32BC4F      335          STA     TXBYTE
0144 32BD4F      336          STA     DATAVA          ;SET DATA AVAILABLE FLAG
0147 21B900      337          LXI     H,TXSTRT        ;SET RETURN VECTOR TO CONVERT DATA AND TRANS.
014A E3          338          XTHL                    ;SWITCH WITH STACK
014B 00          339 RSTAT:   NOP
014C 00          340          NOP
014D 00          341          NOP
014E 00          342          NOP
014F 00          343          NOP
0150 00          344          NOP
0151 3E08        345          MVI     A,08H           ;ENABLE ALL INTERRUPTS
0153 30          346          SIM
0154 3E0D        347          MVI     A,0DH           ;PUT CARRIAGE RETURN INTO CRT BUFFER
0156 32B64F      348          STA     CRTBUF          ;PUT CARRIAGE RETURN IN CRT BUFFER
0159 3A0060      349 RSTATL:  LDA     SSTAT           ;READ STATUS
015C E608        350          ANI     08H             ;ANY RECEIVER INTERRUPTS PENDING
015E C8          351          RZ                      ;IF NO RETURN
015F 3A0060      352          LDA     SSTAT           ;ELSE, READ STATUS AGAIN TO CHECK FOR RXIR
0162 E602        353          ANI     02H             ;IS A RXIR AVAILABLE
0164 CA5901      354          JZ      RSTATL          ;IF NOT, WAIT
0167 3A0360      355          LDA     RXIR            ;ELSE, READ INTERRUPT RESULT BYTE
016A C35901      356          JMP     RSTATL          ;CHECK TO SEE IF ANY MORE RESULTS EXIST
                 357          ;
016D 3AB74F      358 DATCRC:  LDA     GETID           ;SEE IF ANY DATA HAS BEEN INPUT YET
0170 A7          359          ANA     A               ;SEE IF ZERO
0171 C27801      360          JNZ     BADCRC
0174 3E0A        361          MVI     A,0AH           ;ENABLE 7.5 AND 5.5
0176 30          362          SIM
0177 C9          363          RET
0178 3E00        364 BADCRC:  MVI     A,00H
017A 32B74F      365          STA     GETID           ;CLEAR HEADER COUNTER
017D C33301      366          JMP     BADR
                 367          ;
0180 3E0E        368 INBYTE:  MVI     A,0EH           ;SET INTERRUPT MASK TO INPUT SERIAL DATA
0182 30          369          SIM
0183 3AB74F      370          LDA     GETID           ;GET DATA INPUT COUNTER
0186 E603        371          ANI     03H             ;SEE IF DATA, ID, OR ADDRESS IS EXPECTED
0188 C29401      372          JNZ     REALDT          ;IF 2 OR 3, INPUT BYTE IS DATA OR ID
018B 3E02        373          MVI     A,02H
018D 32B74F      374          STA     GETID           ;STORE 2, ADDRESS ALREADY RECEIVED
0190 3A00B0      375          LDA     SDATAI          ;READ ADDRESS TO CLEAR INTERRUPTS
0193 C9          376          RET
0194 FE02        377 REALDT:  CPI     02H             ;IS BYTE DATA OR ID
0196 C2D601      378          JNZ     GETBYT          ;IF VALUE IS 2, INPUT BYTE IS ID
0199 3E03        379          MVI     A,03H
019B 32B74F      380          STA     GETID           ;STORE 3, ID AND ADDRESS ALREADY RECEIVED
019E 3A00B0      381          LDA     SDATAI          ;READ INPUT BYTE, ID
01A1 47          382          MOV     B,A             ;PUT ID INTO REG. B
01A2 3ABB4F      383          LDA     ID              ;GET PREVIOUS PACKET ID
01A5 B8          384          CMP     B               ;ARE THEY THE SAME
01A6 C2BB01      385          JNZ     NEWPAC          ;IF NOT, THIS PACKET IS NOT A RETRANS.
01A9 21BE4F      386 SAMEPC:  LXI     H,SAMPAC        ;PUT LOCATION OF REPEAT PACKET COUNT INTO HL
01AC 35          387          DCR     M               ;DECREMENT CURRENT REPEAT PACKET COUNT
01AD CAB701      388          JZ      RSLOP           ;IF 15 REPEAT HAVE BEEN RECEIVED, RESET BOARD
```

```
01B0 2AA24F     385         LHLD    POINTI          ;ELSE, PACKET IS RETRANS. RESET POINTERS
01B3 22B34F     390         SHLD    CURRENT
01B6 C9         391         RET
01B7 00         392 RSLOP:  NOP                     ;THIS IS A INFINITE LOOP TO RESET BOARD
01B8 C3B701     393         JMP     RSLOP
01BB 78         394 NEWPAC: MOV     A,B             ;PUT NEWLY READ ID BACK INTO A
01BC 32B64F     395         STA     ID              ;STORE NEW PACKET ID
01BF 2AB34F     396         LHLD    CURRENT         ;SINCE NEW DATA, UPDATE POINTERS
01C2 7D         397         MOV     A,L             ;PUT REG. L INTO A
01C3 FE26       398         CPI     26H             ;HAS INPUT LOCATION 2 BEEN LOADED
01C5 C2CA01     399         JNZ     NEWCON          ;IF NOT, PUT DATA THERE
01C8 2E00       400         MVI     L,00H           ;ELSE, PUT DATA IN LOCATION 1
01CA 22B34F     401 NEWCON: SHLD    CURRENT
01CD 22A24F     402         SHLD    POINTI
01D0 3AAD4F     403         LDA     PACKET          ;GET CURRENT PACKET COUNT
01D3 FED0       404         CPI     0D0H            ;IS PACKET COUNT AT MAXIMUM
01D5 C8         405         RZ                      ;IF SO, RETURN
01D6 3C         406         INR     A               ;ELSE, INCREMENT THE PACKET COUNT
01D7 32AD4F     407         STA     PACKET          ;STORE UPDATED VALUE
01DA C9         408         RET
01DB 3E0A       409 GETBYT: MVI     A,0AH           ;SET INTERRUPT MASK TO OUTPUT TO CRT
01DD 30         410         SIM
01DE 2AB34F     411         LHLD    CURRENT         ;GET CURRENT INPUT POINTER
01E1 3A00B0     412         LDA     SDATAI          ;GET INPUT DATA BYTE
01E4 77         413         MOV     M,A             ;SAVE BYTE IN RAM
01E5 32B64F     414         STA     CRTBUF          ;PUT DATA BYTE IN CRT OUTPUT BUFFER
01EB 23         415         INX     H
01E9 22B34F     416         SHLD    CURRENT         ;STORE UPDATED POINTER
01EC C9         417         RET
                418         ;
                419         ;
                420 ;;;
```

```
0215 00          443          NOP                  ;TURN RECEIVER ON AT THIS POINT
0216 21B04F      444 BAD:     LXI     H,ADDRES
0219 22BD4F      445          SHLD    TXPNT
                 446          ;
021C 3A0060      447 STATLP:  LDA     SSTAT        ;GET STATUS BYTE TO CHECK FOR RESULTS
021F E601        448          ANI     01H          ;ARE THERE ANY MORE RESULTS AVAILABLE
0221 CA2A02      449          JZ      TURNON       ;IF NO RESULTS, RETURN (RI)
0224 3A0260      450          LDA     TXIR         ;READ INTERRUPT RESULT BYTE
0227 C31C02      451          JMP     STATLP       ;CHECK FOR MORE RESULT BYTES
022A 217E00      452 TURNON:  LXI     H,RECON      ;LOAD HL WITH RETURN ADDRESS
022D E3          453          XTHL                 ;PUT ON TOP OF STACK
022E 3E0E        454          MVI     A,0EH        ;SET INTR. MASK TO RECEIVE
0230 30          455          SIM
0231 C9          456          RET
0232 2ABD4F      457 OUTBYT:  LHLD    TXPNT        ;GET CURRENT ACK. OUTPUT DATA POINTER
0235 7E          458          MOV     A,M          ;PUT DATA BYTE INTO A
0236 320070      459          STA     SDATAO       ;OUTPUT DATA TO 8273
0239 23          460          INX     H
023A 22BD4F      461          SHLD    TXPNT        ;STORE UPDATED ACK. OUPUT POINTER
023D C9          462          RET
                 463          ;
                 464          ;
                 465 ;;;
```

```
0270 D320       499         OUT     PORT5A          ;STOP LINE LOW
0272 3E00       500         MVI     A,00H
0274 329E4F     501         STA     CNVBUF          ;RESET BUFFER FULL FLAG
0277 328C4F     502         STA     TXFLG           ;RESET TXFLG, NO DATA READY FOR TRANSFER
027A 212640     503         LXI     H,TOPOUT        ;RESET CONVERTER POINTER TO TOP-OF-BUFFER
027D 228A4F     504         SHLD    CNVRTP
0280 C9         505         RET
                506         ;
                507         ;
                508 ;;;
```

```
02C9 212703      555          LXI     H,DTAXS
02CC CDFE02      556          CALL    CMDOUT
02CF 212A03      557          LXI     H,BITS
02D2 CDFE02      558          CALL    CMDOUT
02D5 212F03      559          LXI     H,RCV
02D8 CDFE02      560          CALL    CMDOUT
02DB C9          561          RET
                 562 ;
                 563 ;
02DC 3E80        564 I82502:  MVI     A,80H          ;SET-UP TO LOAD BAUD DIVISOR
02DE 320380      565          STA     8003H          ;WRITE TO LCR, SET DLAB=1
02E1 3E68        566          MVI     A,68H          ;LSB OF DIVISOR, 8MHZ CRYSTAL
02E3 320080      567          STA     8000H          ;4FH FOR 6MHZ CRYSTAL
02E6 3E00        568          MVI     A,00H          ;MSB OF DIVISOR
02E8 320180      569          STA     8001H
02EB 3E07        570          MVI     A,07           ;8-BITS, NO PARITY, 2 STOP BITS
02ED 320380      571          STA     8003H          ;SET-UP OPERATING CONDITIONS
02F0 3E00        572          MVI     A,00H
02F2 320180      573          STA     8001H          ;CLEAR LINE STATUS REGISTER
02F5 320580      574          STA     8005H          ;DISABLE INTERRUPTS
02F8 3E0F        575          MVI     A,0FH
02FA 320480      576          STA     8004H
02FD C9          577          RET
                 578 ;
02FE 0E30        579 CMDOUT:  MVI     C,30H
0300 46          580          MOV     B,M
0301 23          581          INX     H
0302 3A0060      582 CMD1:    LDA     SSTAT
0305 07          583          RLC
0306 DA0203      584          JC      CMD1
0309 7E          585          MOV     A,M
030A 320060      586          STA     SCMDRG
030D 78          587 CMD2:    MOV     A,B
030E A7          588          ANA     A
030F C8          589          RZ
0310 23          590          INX     H
0311 05          591          DCR     B
0312 3A0060      592 CMD3:    LDA     SSTAT
0315 E620        593          ANI     20H
0317 C21203      594          JNZ     CMD3
031A 7E          595          MOV     A,M
031B 320160      596          STA     SPRMRG
031E C30D03      597          JMP     CMD2
                 598 ;
                 599 ;
0321 01          600 OPMODES:         DB      01,91H,00000011B        ;NON-BUFFERED MODE
0322 91
0323 03
0324 01          601 SMODES:          DB      01,0A0H,00000003
0325 A0
0326 00
0327 01          602 DTAXS:           DB      01,97H,00000001B
0328 97
0329 01
032A 01          603 BITS:            DB      01,0A4H,00000000B
032B A4
```

```
032C 00
032D 00          604 DR:         DB      00,0C5H
032E C5
032F 02          605 RCV:        DB      02,0C0H,15H,00H         ;RECEIVE 19 BYTES
0330 C0
0331 15
0332 00                                                          ;PLUS ADDRESS AND ID
                 606 ;
                 607 ;
                 608 ;
0333 3E02        609 IXMIT:  MVI     A,02H           ;TWO PARAMETERS IN COMMAND
0335 324F4F      610         STA     XMIT            ;STORE IN RAM
0338 3EC8        611         MVI     A,0C8H          ;GENERAL TRANSMIT COMMAND
033A 324B4F      612         STA     XMIT+1
033D 3E03        613         MVI     A,03H           ;LSB OF PACKET LENGTH
033F 324A4F      614         STA     XMIT+2
0342 3E00        615         MVI     A,00H           ;MSB OF PACKET LENGTH
0344 324A4F      616         STA     XMIT+3
0347 C9          617         RET
                 618         ;
                 619         ;
                 620 ;;;
```

```
                        655 ;;;
```

```
                        711         ;
03AF 2A924F             712         LHLD    HPSAVE          ;GET CONVERTER POINTER
03B2 2B                 713         DCX     H               ;POINT AT THIRD DIGIT
03B3 7E                 714         MOV     A,M             ;GET DIGIT
03B4 D630               715         SUI     30H             ;CONVERT TO HEX
03B6 21000C             716         LXI     H,LT10          ;PUT LOOK-UP TABLE BASE ADDRESS IN HL
03B9 85                 717         ADD     L               ;INCREMENT BASE TO APPROPRIATE MULTIPLIER
03BA 6F                 718         MOV     L,A
03BB 5E                 719         MOV     E,M             ;GET THE MULTIPLIER
03BC 1600               720         MVI     D,00H
03BE 2A944F             721         LHLD    BYTE12          ;GET CURRENT VALUE OF BYTEES 1 AND 2
03C1 CDD504             722         CALL    WORDAD          ;ADD THE CURRENT VALUE TO THE PRODUCT
03C4 22944F             723         SHLD    BYTE12          ;STORE THE NEW VALUE FOR BYTEES 1 AND 2
                        724         ;
03C7 2A924F             725         LHLD    HPSAVE
03CA 2B                 726         DCX     H
03CB 2B                 727         DCX     H
03CC 7E                 728         MOV     A,M             ;GET SECOND DIGIT
03CD D630               729         SUI     30H             ;CONVERT
03CF 87                 730         ADD     A
03D0 21000B             731         LXI     H,LT100         ;GET BASE ADDRESS
03D3 85                 732         ADD     L               ;OFFSET THE ADDRESS
03D4 6F                 733         MOV     L,A
03D5 5E                 734         MOV     E,M             ;GET MULTIPLIER
03D6 23                 735         INX     H
03D7 56                 736         MOV     D,M
03D8 2A944F             737         LHLD    BYTE12          ;GET BYTEES 1&2
03DB CDD504             738         CALL    WORDAD          ;ADD THE PRODUCT TO THE CURRENT VALUE
03DE 22944F             739         SHLD    BYTE12          ;STORE NEW VALUE
                        740         ;
03E1 2A924F             741         LHLD    HPSAVE
03E4 2B                 742         DCX     H
03E5 2B                 743         DCX     H
03E6 2B                 744         DCX     H
03E7 7E                 745         MOV     A,M             ;GET FIRST DIGIT
03E8 2B                 746         DCX     H
03E9 22924F             747         SHLD    HPSAVE
03EC D630               748         SUI     30H             ;CONVERT
03EE 87                 749         ADD     A
03EF 21000A             750         LXI     H,LT1000        ;GET BASE ADDRESS
03F2 85                 751         ADD     L               ;OFFSET BASE
03F3 6F                 752         MOV     L,A
03F4 5E                 753         MOV     E,M             ;GET MULTIPLIER
03F5 23                 754         INX     H
03F6 56                 755         MOV     D,M
03F7 2A944F             756         LHLD    BYTE12          ;GET CURRENT VALUE
03FA CDD504             757         CALL    WORDAD          ;ADD THE VALUES
03FD 3EC0               758         MVI     A,0C0H          ;INSURE THE FIRST TWO BITS OF MSB ARE SET
03FF B4                 759         ORA     H
0400 67                 760         MOV     H,A
0401 22944F             761         SHLD    BYTE12          ;STORE FINAL VALUE OF BYTEES 1 AND 2
                        762         ;
                        763         ;
                        764 ;;;
```

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                    767 ; EXISTING VALUE OF BYTEES 1 AND 2.
                    768 ;;;
```

```
0440 07          823         RLC
0441 07          824         RLC
0442 B0          825         ORA     B               ;COMBINE REGISTERS A AND B
0443 6F          826         MOV     L,A
0444 2600        827         MVI     H,00H
0446 229A4F      828         SHLD    BYTE78          ;SAVE WORD #3, BYTES 7 AND 8
                 829         ;
0449 2A924F      830         LHLD    HPSAVE
044C 2B          831         DCX     H
044D 2B          832         DCX     H
044E 7E          833         MOV     A,M             ;GET THIRD DATA DIGIT
044F D630        834         SUI     30H
0451 47          835         MOV     B,A
                 836         ;
0452 2B          837         DCX     H
0453 7E          838         MOV     A,M             ;GET FOURTH DATA DIGIT
0454 D630        839         SUI     30H
0456 07          840         RLC
0457 07          841         RLC
0458 07          842         RLC
0459 07          843         RLC
045A B0          844         ORA     B
045B 6F          845         MOV     L,A
045C 2600        846         MVI     H,00H
045E 22984F      847         SHLD    BYTE56          ;STORE BYTES 5 AND 6, WORD #2
                 848         ;
                 849         ;
                 850 ;;;
```

```
047D 7C          879         MOV     A,H
047E 12          880         STAX    D
047F 13          881         INX     D
                 882         ;
0480 2A9A4F      883         LHLD    BYTE78          ;GET FOURTH WORD
0483 7D          884         MOV     A,L
0484 12          885         STAX    D
0485 13          886         INX     D
0486 7C          887         MOV     A,H
0487 12          888         STAX    D
0488 13          889         INX     D
                 890         ;
0489 EB          891         XCHG
048A CDF600      892         CALL    OVERFL          ;SEE IF BUFFER POINTER IS STILL IN RANGE
048D 229A4F      893         SHLD    CNVRTP          ;SAVE NEW OUTPUT BUFFER POINTER
                 894         ;
0490 21AD4F      895         LXI     H,PACKET        ;PUT THE ADDRESS OF PACKET INTO HL
0493 35          896         DCR     M               ;DECREMENT THE CURRENT PACKET COUNT
0494 218C4F      897         LXI     H,TXFLG         ;PUT ADDRESS OF TXFLG IN HL
0497 36FF        898         MVI     M,0FFH          ;SET DATA AVAILABLE FOR TRANSFER FLAG
0499 3E00        899         MVI     A,00H
049B 328D4F      900         STA     DATAVA          ;RESET DATA AVAILABLE FLAG
049E C9          901         RET
                 902         ;
                 903         ;
                 904         ;
                 905 ;;;
```

```
04BA 15          935 OLP1:   DCR     D
04BB CACA04      936         JZ      NOWADD
04BE 17          937         RAL
04BF D2BA04      938         JNC     OLP1
04C2 6F          939         MOV     L,A
04C3 7C          940         MOV     A,H
04C4 17          941         RAL
04C5 67          942         MOV     H,A
04C6 7D          943         MOV     A.L
04C7 C3BA04      944         JMP     OLP1
                 945         ;
04CA EB          946 NOWADD: XCHG
04CB 2A9C4F      947         LHLD    VALUE
04CE 7D          948         MOV     A,L
04CF 83          949         ADD     E
04D0 6F          950         MOV     L,A
04D1 7C          951         MOV     A,H
04D2 8A          952         ADC     D
04D3 67          953         MOV     H,A
                 954         ;
04D4 C9          955 DONE:   RET
                 956         ;
                 957         ;
                 958 ;;;
```

```
INBYTE A 0180    INCOME A 4FA4    INPDAT A 0107    IXMIT  A 0333    LCR    A 9003    LT10   A 0C00    LT100  A 0B00
LT1000 A 0A00    MLOOP  A 00A7    MLOOP2 A 00AB    MLOOP3 A 0090    MRESET A 001F    MSTOP  A 002F    MULTI  A 049F
MUXRUN A 00FF    MUXWR  A D000    NEWCON A 01CA    NEWPAC A 0188    NOWADD A 04CA    ODD    A 04Ba    OFFSET A 035D
OLP1   A 045A    OPMODE A 0321    OUTACK A 01ED    OUTBYT A 0232    OUTCRT A 0281    OUTDON A 026A    OVERFL A 00Fa
PACKET A 4FAC    POINT1 A 4FAE    POINTO A 4FA0    PORT4A A 0010    PORT4B A 0011    PORT4C A 0012    PORT5A A 0020
PUTLF  A 0250    RAM    A 4000    RCV    A 032F    REALDT A 0194    RECON  A 007E    RESET  A E000    RESULT A 0001
RSLOF  A 0187    RSTAT  A 014B    RSTATL A 0159    RXIR   A 6003    SAMEPC A 01A9    SAMPAC A 4F6E    SCNDRB A 6000
SDATAI A B000    SDATAO A 7000    SNDDES A 0324    SPRMRG A 6001    SSTAT  A 6000    START  A 0051    STATLP A 021C
STATUS A 4F65    TLI    A 0047    TOPOUT A 402a    TURNON A 022A    TX1    A 00EB    TXBYTE A 4FBC    TXCONT A 00EF
TXFLG  A 4F6C    TXIF   A 6002    TXLOOP A 00E5    TXPNT  A 4FBE    TXSTAT A 4FA5    TXSTRT A 006A    VALUE  A 4F2C
WORDAD A 0405    XMIT   A 4FA7

ASSEMBLY COMPLETE,  NO ERRORS
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What is claimed is:

1. A method for implementing telephone-based purchase requests by a subscriber, said subscriber having a telephone unit served by a telephone company central office, said telephone company central office using a computer which, in response to a telephone call from the subscriber, provides a calling line data message which includes an origination telephone number for the calling subscriber and destination telephone number data entered by the calling subscriber via his telephone unit to indicate said purchase request, comprising the steps of:

electronically receiving a calling line data message from the telephone company central office;

applying first information representing the origination telephone number of the subscriber directly to a system controller at an operator station, said system controller having access to authorization information editable by a billing system concerning the eligibility of the subscriber for said purchase request;

determining from said first information and said authorization information whether the subscriber making the request is eligible to make the purchase; and

if said determining step indicates that the subscriber is eligible for said purchase, then executing the request and indicating the transaction to a billing system.

2. The method of claim 1 wherein said receiving step is done in real time at said telephone company central office and the method further includes communicating only a portion of said received calling line data message to said operator station.

3. The method of claim 2 including buffering said portion of said calling line data message at said telephone company central office.

4. The method of claim 3 including receiving said calling line data message asynchronously and communicating said portion of said calling line data message synchronously to said operator station.

5. A method of implementing telephone-based pay per view requests by subscribers to view pay per view events, each of said subscribers having an addressable access terminal unit, each subscriber having a telephone unit, said telephone units being served by telephone company central offices, each of said telephone company central offices using a computer which, in response to a telephone call from a calling subscriber, provides a calling line data message which includes an origination telephone number for the calling subscriber and destination telephone number data entered by the calling subscriber via his telephone unit to indicate a pay per view request, comprising the steps of:

electronically receiving a plurality of calling line data messages from respective calling subscribers at plural telephone company offices;

electronically transmitting at least the origination telephone number portion and the destination telephone number data portion of each of the calling line data messages to a headend station;

electronically receiving said origination telephone number portion and said destination telephone number data portion of each of said calling line data messages at said headend station and applying said telephone number portions directly to a system controller;

locating, using said system controller, stored data indicating whether said calling subscribers are eligible to view the requested pay per view events, at least a portion of said stored data having been responsive to input from a billing system, said locating step occurring at said headend station and employing said telephone number portions; and

addressing and updating data stored in the calling subscriber' access terminal units if said stored data indicates that said calling subscribers are eligible to view the requested pay per view events.

6. The method of claim 5 wherein the step of electronically receiving a plurality of calling line data messages at each of plural telephone company central offices occurs in real time and the method further includes buffering said portions of the calling line data messages at each of the telephone company central offices.

7. The method of claim 6 including providing communication units located at respective telephone central offices to receive said calling line data messages, strip data therefrom to provide compressed data, said compressed data including said portions of calling line data messages, providing corresponding communication controllers located at said headend station, and transmitting said compressed data to said corresponding communication controllers.

8. The method of claim 7 including buffering said portions of the calling line data messages at said communication controllers and multiplexing said portions of the buffered calling line data messages to apply them to said system controller.

9. The method of claim 7, further comprising a data conversion step occurring at said communication controllers.

10. The method of claim 8 wherein said multiplexing step includes sequentially addressing each of said com-

munication controllers and permitting each addressed controller to communicate said buffered data for a time which depends on the time required for a communication controller to communicate all of its buffered data ready for output.

11. The method of claim 10 wherein when each of said communication controllers is addressed, if it has buffered data ready to be communicated, an interruption of said sequentially addressing occurs.

12. The method of claim 11 wherein said multiplexing step includes sequentially addressing said controllers with a multiplexer and communicating buffered data from said controllers to said multiplexer, the method further including buffering data at said multiplexer.

13. The method of claim 12 wherein after said multiplexer addresses a communication controller, the addressed communication controller interrupts said sequential addressing and verifies that the address outputted by said multiplexer after said sequential addressing has been interrupted is the address of said addressed communication controller, and if so, thereafter communicates buffered data to said multiplexer.

14. The method of claim 11 including refraining from said interrupting said step of sequentially addressing if the addressed controller determines that data is to be inputted thereto.

15. The method of claim 12 wherein said step of sequentially addressing is interrupted if inadequate buffering capability exists at said multiplexer.

16. The method of claim 9 wherein the origination telephone number portion of a calling line data message includes a plurality of ASCII digits and wherein said data conversion step includes converting said ASCII digits into a binary number.

17. The method of claim 16 wherein two of the ASCII digits are converted into a binary number by:

subtracting 30 hexadecimal from the ASCII digit in the one's place to produce a one's place binary value;

subtracting 30 hexadecimal from the ASCII digit in the ten's place to produce a ten's place binary value;

combining the ten's place binary value with a ten's place look-up table base address to produce a ten's place look-up table address;

addressing a look-up table with the ten's place look-up table address to produce a weighted ten's place binary value; and

adding the weighted ten's place binary value to the one's place binary value to produce the binary number equivalent to the two digit ASCII number.

18. The method of claim 16 wherein the origination telephone number portion of a calling line data message includes a three digit ASCII number representing the area code of a calling subscriber and wherein the three digit ASCII area code number is converted into a two bit binary value by:

subtracting 30 hexadecimal from the first ASCII digit to produce a first binary value;

subtracting 30 hexadecimal from the second ASCII digit to produce a second binary value;

rotating the second binary value left four places to produce a rotated second binary value;

adding the first binary value to the rotated second binary value and storing the sum in a first register location;

subtracting 30 hexadecimal from the third ASCII digit to produce a third binary value;

adding a look-up table base address to the third binary value and storing the sum in a second register location;

combining the values stored in the first and second register locations to produce a register pair; and

addressing a memory with the register pair to locate the two bit binary value corresponding to the ASCII area code value.

19. A method for executing a telephone-based pay per view ("PPV") request to view an event in a system having a headend station and numerous subscribers remotely located from said headend station, said subscribers having telephone units served by plural telephone company central offices and having one-way addressable access terminal units, comprising the steps of:

receiving calling line data messages from Automatic Number Identification ("ANI") computers coupled to the plural telephone company central offices, each of said calling line data messages including an origination telephone number for a respective calling subscriber making a PPV request and a destination telephone number entered by the calling subscriber via his telephone unit to indicate a PPV request, said receiving step occurring at each of said telephone company central offices in real time;

stripping unnecessary data received from said ANI computers and buffering the resulting data at units associated with respective central offices; then

separately communicating said resulting data from each of said units to corresponding communication controllers located at the headend station;

converting the format of data received by said communication controllers and temporarily storing converted data thereat;

communicating said converted data from said communication controllers directly to a system controller at the headend station at a high transfer rate, said system controller having stored data therein for said subscribers, said stored data having been responsive to input from a billing system;

locating said stored data for said calling subscribers by using said origination telephone numbers and determining whether said stored data indicates that said calling subscribers can view said PPV event; and

communicating address codes and authorization codes to said addressable access terminal units.

20. The method of claim 19 further including communicating a transaction to said billing system after said last-named communicating step, and wherein said resulting data includes both origination and destination telephone numbers.

21. A system for executing a telephone-based per pay per view (PPV) request, the system having a headend station and numerous subscribers remotely located from the headend station, said subscribers having telephone units served by a telephone company central office and having one-way addressable access terminal units, comprising:

a receiving circuit coupled to an Automatic Number Identification (ANI) computer at the telephone company central office for receiving message data representing a request from a calling subscriber, said data including the calling subscriber's telephone number and data representing an event as to which a transaction is requested by the calling subscriber;

a communication link between said receiving circuit and the headend station;

a system controller located at the headend station for electronically mapping the telephone number portion of said message data into subscriber data stored in said system controller, said subscriber data including eligibility data indicating whether the calling subscriber is eligible to receive the event;

a billing system coupled to said system controller, said billing system being able to alter said eligibility data;

a coupling circuit coupling said message data directly to said system controller, said system controller determining from said eligibility data and said message data whether the calling subscriber is eligible to view said event and if so, then authorizing said addressable access terminal units to be addressed; and

an encoding circuit responsively coupled to said system controller for communicating with the access terminal units associated with said calling subscriber.

22. The system according to claim 21 wherein said receiving circuit includes means for stripping unnecessary data from said message data and a buffer coupled to said means for stripping for temporarily storing data to be transmitted over said communication link.

23. The system of claim 22 including means for synchronously communicating data over said communication link.

24. The system according to claim 21 wherein said headend station includes means for buffering data received via said communication link.

25. The system according to claim 21 wherein said coupling circuit includes a communication controller coupled to said communication link.

26. The system according to claim 25 wherein said communication controller includes means for buffering data received via said communication link and further includes means for converting into binary form the data representative of the telephone number of the subscriber and for coupling said binary form data to said system controller.

27. A system for executing telephone-based pay per view (PPV) requests to view an event, the system having a headend station and numerous cable subscribers remotely located from said headend station, said subscribers having telephone units served by plural telephone company central offices, each subscriber having at least one one-way addressable access terminal unit, comprising:

plural circuits for receiving data representing calling subscriber requests, including the calling subscriber telephone numbers, from Automatic Number Indentification (ANI) computers assocated with the telephone company central offices;

plural communication links each arranged for coupling a respective one of said circuits for receiving to said headend station;

a system controller at said headend station;

a coupling circuit at said headend station for coupling said calling subscriber telephone numbers to said system controller; said system controller being operable to map said subscriber telephone numbers into subscriber data, said subscriber data including eligibility data indicating whether the calling subscribers are eligible to receive the requested event;

a billing system coupled to said system controller, said billing system being able to alter said eligibility data; said system controller determining from said eligibility data whether the calling subscribers are eligible to view the requested event; and

an encoding circuit responsively coupled to said system controller for communicating authorization codes to the access terminal units of the calling subscribers.

28. The system according to claim 27 wherein each of said circuits for receiving includes a buffer for storing data.

29. The system according to claim 28 wherein each said circuit for receiving further includes means for stripping unneeded information from the data received from said ANI computer, said means for stripping being coupled to said buffer.

30. The system according to claim 27 wherein said coupling circuit includes means for buffering data received at said headend station via said communication link.

31. The system according to claim 27 wherein said coupling circuit includes plural communication controllers each coupled via a respective communication link to a respective circuit for receiving, and coupled also to said system controller.

32. The system according to claim 31 wherein each of said communication controllers includes means for buffering data received via its corresponding communication link.

33. The system according to claim 32 wherein each communication controller includes means for converting data received via said communication link into binary data.

34. The system according to claim 33, wherein said coupling circuit further includes a multiplexer coupled to each of said plural communication controllers and to said system controller.

35. The system according to claim 34 wherein said multiplexer includes means for sequentially addressing said communication controllers, and wherein each communication controller includes means responsive to a preselected address generated by said multiplexer, means for interrupting said sequential addressing by said multiplexer, each of said communication controllers being responsive to said interrupting for transferring temporarily stored data to said multiplexer.

36. The circuit according to claim 35 wherein each of said communication controllers includes a respective logic means for determining whether data received via said communication link is good data and for acknowledging to a corresponding circuit for receiving the receipt of good data, for converting the received data into binary data, and for loading said converted binary data into said buffer to await transmission to said multiplexer.

37. The system according to claim 36 wherein said multiplexer includes a counting circuit having an output, said system including a bus for coupling said counting circuit output to each of said communication controllers, each of said communication controllers including means for providing a predetermined count and including a comparison circuit for producing an equality signal when said counting circuit output is equal to said predetermined count, said logic means being responsive to said equality signal to enable a stop signal, said stop signal being coupled to said counting circuit and said counting circuit being inhibited when said stop signal is enabled.

38. The system according to claim 37 wherein said logic means is operative for checking the counting circuit output after said counting circuit stops, and for transferring data from said communication controller to said multiplexer if the counting circuit output after said counting circuit has stopped corresponds to the predetermined count within said communication controller.

39. The system according to claim 36 wherein said logic means is operative to cause the transfer of all converted data stored in said buffer in said communication controller to said multiplexer after said multiplexer has been interrupted from further sequential addressing.

40. The system according to claim 35 wherein said multiplexer includes a temporary storage device and a logic circuit coupled to said temporary storage device, said storage device being coupled to an input of said multiplexer, said input being coupled to each of said communication controllers, said logic circuit being operative for temporarily storing data received at said input in said storage device.

41. The system according to claim 40 wherein said multiplexer includes means associated with said storage device for indicating when said storage device has reached a predetermined level regarding its storage capacity, said means for indicating being coupled to said means for sequentially addressing communication controllers, said means for sequentially addressing being responive to said means for indicating to interrupt the sequential addressing.

42. The system according to claim 31 wherein said system controller includes an input buffer and an output buffer, said input buffer being coupled to receive a set of data words representing said subscriber requests, said system controller processing data taken from said input buffer and determining said address codes and said authorization codes corresponding to the subscriber requests, and providing said codes to said output buffer.

43. The system according to claim 42 wherein said system controller includes first and second input buffers and first and second output buffers, said system controller controlling said input and output buffers for receiving data from said communication controllers at one of said input buffers while processing data contained in other of said buffers; said output buffers communicating with said encoding circuit, one of said output buffers being operable for receiving data processed by said system controller while the other of said buffers is communicating data to said encoding circuit.

44. A system for executing telephone-based pay per view (PPV) requests from subscribers to view a PPV event, the system having a headend station and numerous subscribers remotely located from the headend station, said subscribers having telephone units served by a telephone company central office and having one-way addressable access terminal units comprising:

a plurality of communication units each located at a respective telephone company central office and each communicating with a respective ANI computer for receiving calling line message data therefrom including the telephone number of each subscriber calling said telephone company central office with a request to view said PPV event and a destination telephone number which indicates said PPV event;

a plurality of communication controllers located at said cable headend station, each corresponding to a respective communication unit;

a plurality of first communication links for coupling each of said communication units to its corresponding communication controller;

a second communication link coupled to all of said communication controllers for receiving data therefrom, including the telephone numbers of said subscribers who have called to request said event;

a system controller directly coupled to said second communication link for receiving data therefrom and for mapping said telephone numbers into respective blocks of stored data each of which includes, for the respective subscriber, the subscriber's access terminal unit address and eligibility data indicative of whether the calling subscriber may view said PPV event, said blocks of data being stored in said system controller;

an encoding circuit responsively coupled to said system controller for communicating data to the access terminal units of those subscribers whose said eligibility data indicates that they are entitled to view said PPV event;

a billing system coupled to said system controller for updating said eligibility data;

each of said communication units including a logic means responsive to the receipt of data from the corresponding ANI computer for stripping therefrom unnecessary data, each of said communication units including a storage device, said logic means being operable to store data remaining after said stripping in said storage device;

each of said communication controllers including logic means and a storage device, said logic means being operative for causing data received at said communication controller via the corresponding first communication link to be stored temporarily in said storage device and for converting the format of data into binary form.

45. The system according to said claim 44 wherein said second communication link comprises a multiplexer which includes means for sequentially addressing each of said communication controllers and means for interrupting said sequentially addressing means; wherein the logic means in each of said communication controllers determines that said communication controller is being addressed by said multiplexer and, in response, activates said means for interrupting said sequential addressing until after the transfer of temporarily stored data from said communication controller to said multiplexer.

46. The system according to claim 44 further including means for communicating to said billing system data representative of said PPV requests which have been mapped by said system controller thereby to adjust data for the subscriber to reflect their PPV requests which have been processed.

47. The method of claim 1 wherein said applying step comprises mapping the subscribers origination telephone number into a block of data concerning the subscriber, said block indicating whether the subscriber is eligible to make the requested purchase, at least a portion of said block of data corresponding to said information received from said billing system; said comparing step comprising determining the contents of a portion of said block of data.

48. The method of claim 47 further comprising buffering said calling line data message at said telephone company central office; stripping data from said calling line data message; and transmitting the remaining data after said stripping step to said operator station; said

mapping step occurring at said cable operator station.

49. The method of claim 1 wherein said authorization information is located in said system controller.

50. The method of claim 1 wherein said authorization information comprises a flag which is editable by said billing system.

51. The method of claim 5 wherein said stored data is located in said system controller.

52. The method of claim 51 wherein said stored data comprises a flag and wherein said billing system is operable to edit said flag from time to time.

53. The method of claim 9 wherein said communication units strip unnecessary data from said calling line data messages to provide compressed calling line data; and wherein said communication controllers reorganize said compressed calling line data and convert the format thereof into one or more binary formats.

54. The method of claim 53 wherein each of said communication controllers:

converts the origination telephone numbers which it receives by reading a look-up table for a first portion of each respective origination telephone number to provide a first binary number;

converts a second portion of the origination telephone number into a second binary number; and

combines said first and second binary numbers into a third binary number which it communicates to said system controller.

55. The method of claim 19 wherein said stored data inlcues a flag which is able to be updated from time to time by said billing system.

56. The method of claim 21 wherein said eligibility data comprises a flag.

57. A method for implementing telephone-based pay per view ("PPV") requests by subscribers to view a PPV event, each said subscriber having a telephone unit served by a telephone company central office and having an addressable access terminal unit, said telephone company central office using apparatus which, in response to a telephone call from the subscriber, provides a corresponding calling line data message which includes the origination telephone number for calling subscriber and the destination telephone number data entered by the calling subscriber via the subscriber's telephone unit to indicate the PPV request, comprising the steps of:

electronically receiving calling line data messages from the telephone company central office in a first data format;

stripping unnecessary data from said each calling line data message to provide a plurality of compressed data measages each of which includes the origination telephone number and said destination number of a calling subscriber;

temporarily storing said plurality of said compressed data messages;

transmitting said plurality of compressed data messages via a communication link to a headend office;

receiving said plurality of compressed data messages at a communication controller at said headend station;

converting the format of the portions of said compressed data messages which include the origination telephone numbers received by said communication controllers into binary format, including finding a first binary number in a look-up table for a first portion of an origination telephone number, converting a second portion of said origination telephone number into a second binary number, and converting a third portion of said origination telephone number into a binary format; said communication controller also converting said destination telephone number into a binary format; and

communicating said binary numbers directly to a system controller, said system controller locating, from each said origination telephone number, a data block for the corresponding calling subscriber, said data block including a flag which indicates whether said calling subscriber may receive said PPV event; said data block flags being editable by a billing system; said system controller updating the addressable access terminal unit of a said calling subscriber if the corresponding said flag indicates that said calling subscriber is eligible to view said PPV event.

58. The method according to claim 57 wherein said destination telephone numbers are converted into binary coded decimal and wherein said system controller uses said first and second binary numbers to look up further information to find said data block.

59. The method according to claim 57 wherein said communication controller consults a look-up table to determine a first number of binary bits indicating the area code of said origination telephone number, consults a look up table to determine a second number of binary bits indicating a second portion of said telephone origination number, and combines said first and second binary numbers.

60. The method of claim 57 wherein said data blocks are stored in said system controller.

61. The method of claim 1 wherein said applying step includes receiving information at first and second input buffers alternately, said system controller performing said comparing step on information which has been stored in one of said input buffers while information is being received at the other said input buffer, said system controller loading processed data into first and second output buffers alternately, the method further comprising communicating said processed data from said output buffers to an encoding circuit, one of said output buffers communicating with said encoding circuit while the other said output buffer receives said processed data from system controller.

62. The system of claim 27 wherein said subscriber data is stored in said system controller.

63. The method of claim 1 wherein said purchase requests are for pay per view video events, wherein said subscriber has an addressable access terminal unit and wherein said executing step comprises addressing said access terminal units to permit the pay per view event to be viewed.

* * * * *

Declassified per 3 CFR 2009

United States Patent [19]

Collins et al.

[11] **Patent Number: 4,656,624**

[45] **Date of Patent: Apr. 7, 1987**

[54] **OPERATOR COMMUNICATION ARRANGEMENTS FOR OPERATOR ASSISTANCE SYSTEMS**

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[73] Assignee: **AT&T Bell Laboratories,** Murray Hill, N.J.

[21] Appl. No.: **730,765**

[22] Filed: **May 3, 1985**

[51] **Int. Cl.**[4] **H04M 3/60; H04Q 11/04**

[52] **U.S. Cl.** **370/60; 370/62; 379/94; 379/265**

[58] **Field of Search** ..... 370/60, 94, 85, 62; 179/27 D

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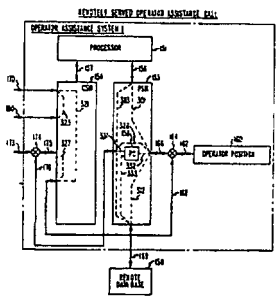
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Primary Examiner—Douglas W. Olms
Assistant Examiner—Curtis Kuntz
Attorney, Agent, or Firm—Werner Ulrich; Peter Visserman

[57] **ABSTRACT**

An operator or agent position, for use by a telephone assistance operator or an agent of a business, communicates with the circuit and packet switching network of a telecommunication switching system using an Integrated Devices Digital Network (ISDN) B-channel and D-channel. The switching network is connected to customers, positions, data communication paths to data bases, and a data path to control processor of the system. The B-channel is connected through a circuit switching network to a customer. The D-channel is connected through a packet switching network to the control processor and to data bases. Advantageously, the positions can be located remotely from the switching network because only a single integrated facility is required to transmit the integrated voice and data signal between a position and the network. Advantageously, a variety of data bases can be rapidly and efficiently accessed by a position.

25 Claims, 14 Drawing Figures



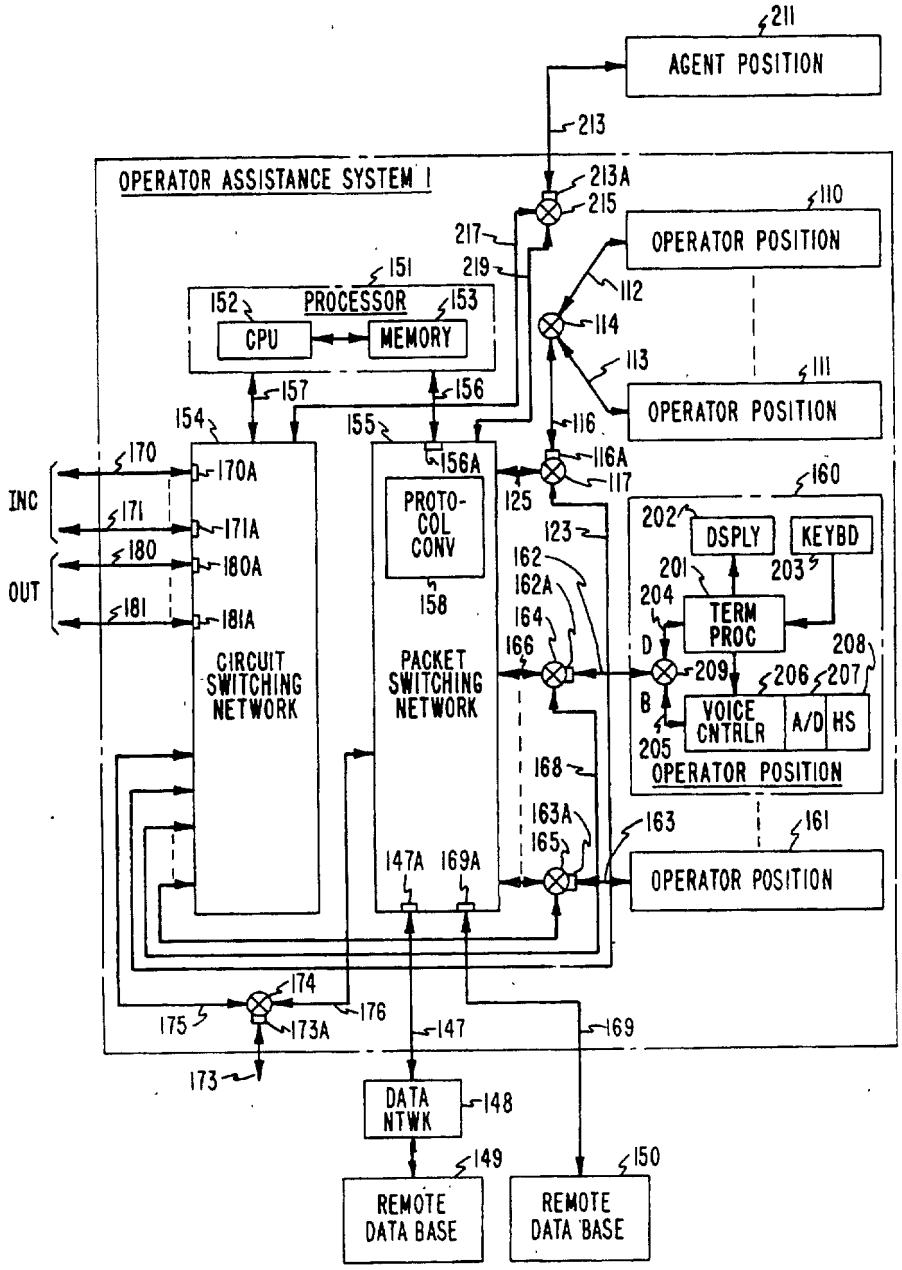

211
AGENT POSITION
213
OPERATOR ASSISTANCE SYSTEM I
213A
215
110
OPERATOR POSITION
217
219
151
PROCESSOR
152
CPU
153
MEMORY
112
114
113
111
OPERATOR POSITION
157
156
154
155
116
116A
117
156A
170
170A
INC
171
171A
180
180A
OUT
181
181A
PROTO-
COL
CONV
158
125
160
202
DSPLY
KEYBD
123
162
162A
164
166
201
203
204
TERM
PROC
D
208
209
206
207
B
VOICE
CNTRLR
A/D
HS
205
OPERATOR POSITION
CIRCUIT
SWITCHING
NETWORK
PACKET
SWITCHING
NETWORK
168
163A
165
163
161
147A
169A
OPERATOR POSITION
174
175
176
173A
147
169
173
DATA
NTWK
148
149
150
REMOTE
DATA BASE
REMOTE
DATA BASE

FIG. 1

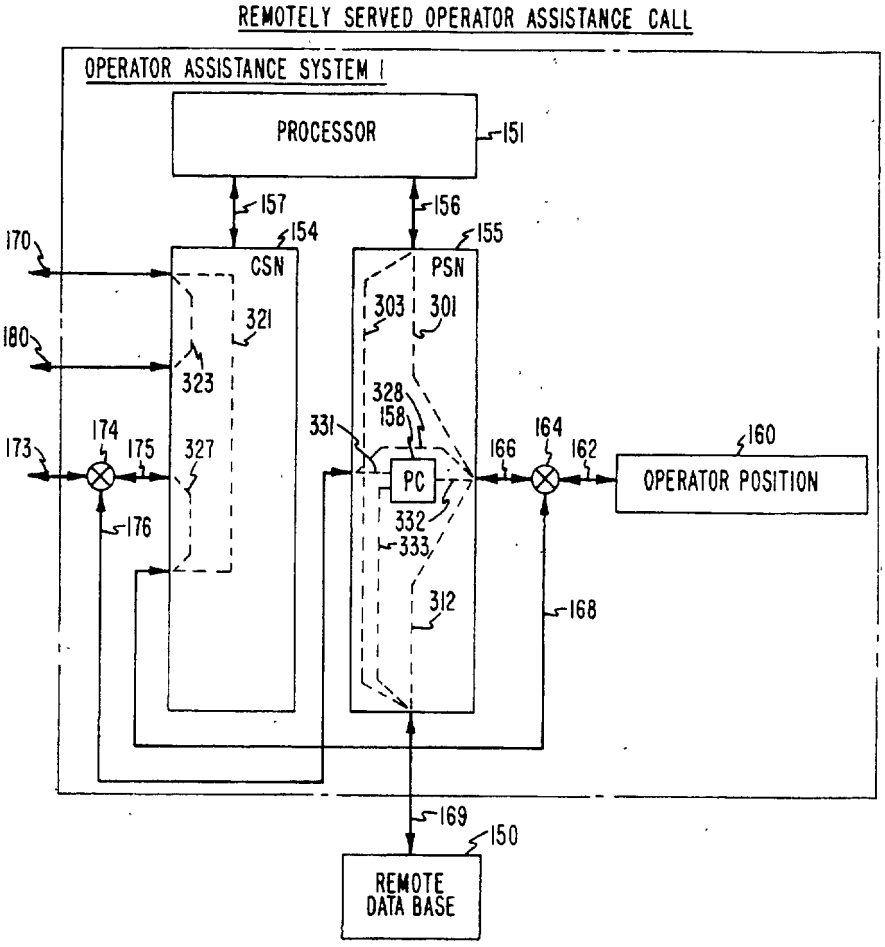

REMOTELY SERVED OPERATOR ASSISTANCE CALL
OPERATOR ASSISTANCE SYSTEM I
PROCESSOR
151
157
156
154
155
CSN
PSN
170
180
173
321
323
303
301
328
158
331
174
175
327
176
PC
166
164
162
160
OPERATOR POSITION
332
333
312
168
169
150
REMOTE DATA BASE

FIG. 2

FIG. 3

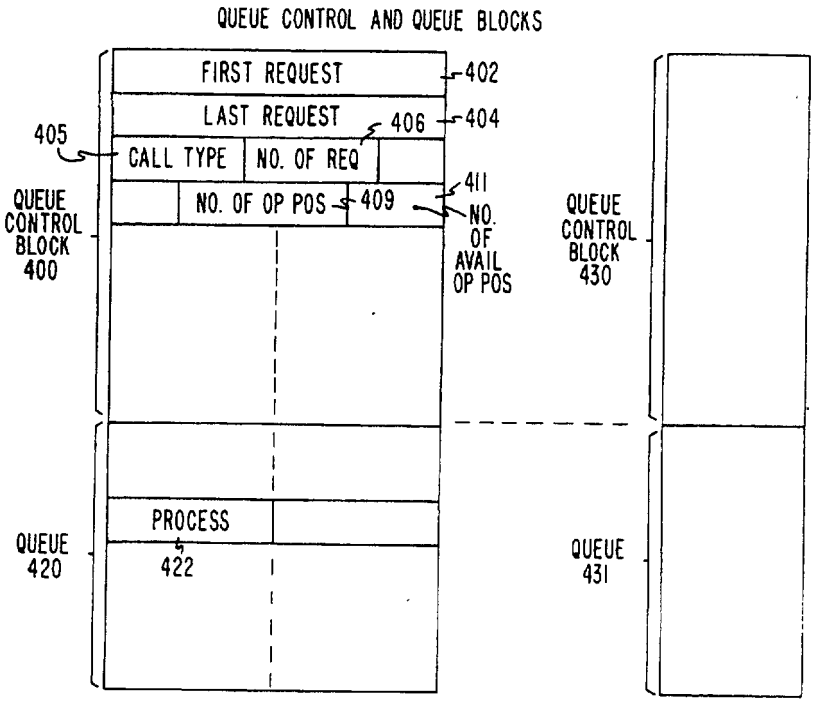

QUEUE CONTROL AND QUEUE BLOCKS
FIRST REQUEST
402
LAST REQUEST
406
404
405
CALL TYPE
NO. OF REQ
411
NO. OF OP POS
409
NO. OF AVAIL OP POS
QUEUE CONTROL BLOCK 400
QUEUE CONTROL BLOCK 430
PROCESS
422
QUEUE 420
QUEUE 431

FIG. 4

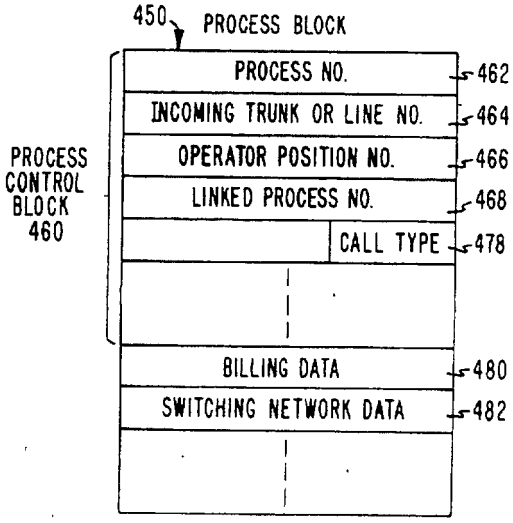

450
PROCESS BLOCK
PROCESS NO.
462
INCOMING TRUNK OR LINE NO.
464
OPERATOR POSITION NO.
466
LINKED PROCESS NO.
468
CALL TYPE
478
PROCESS CONTROL BLOCK 460
BILLING DATA
480
SWITCHING NETWORK DATA
482

FIG. 5

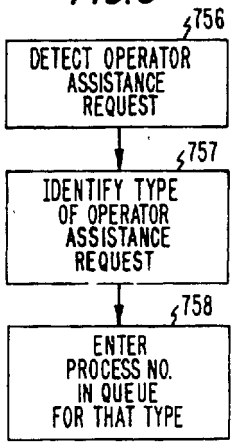


FIG. 6

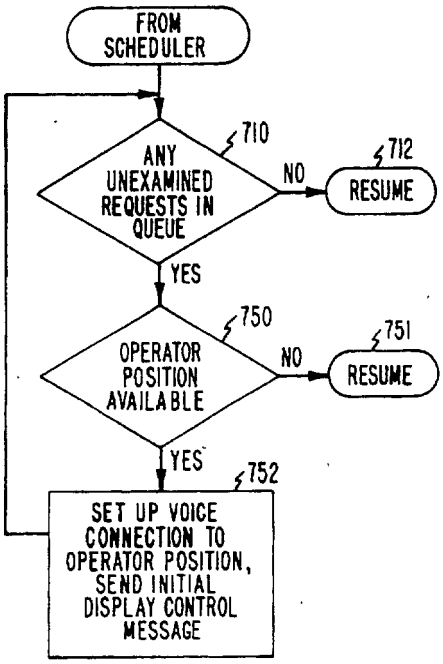
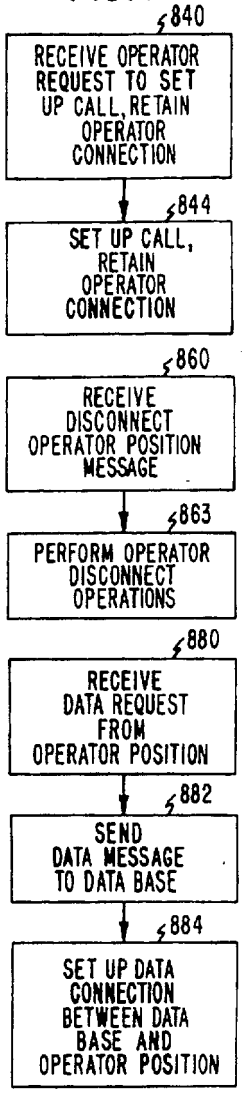


FIG. 7



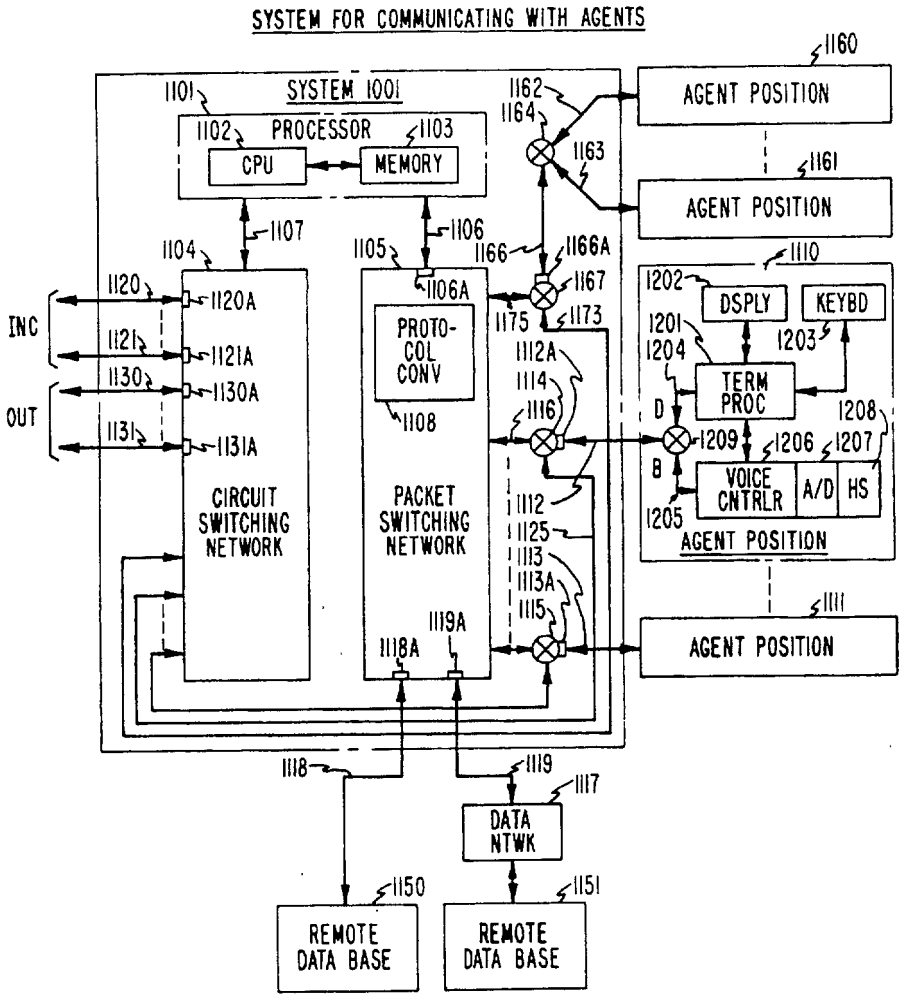

SYSTEM FOR COMMUNICATING WITH AGENTS
SYSTEM 1001
PROCESSOR
CPU
MEMORY
PROTO-COL CONV
CIRCUIT SWITCHING NETWORK
PACKET SWITCHING NETWORK
INC
OUT
AGENT POSITION
DSPLY
KEYBD
TERM PROC
VOICE CNTRLR
A/D
HS
DATA NTWK
REMOTE DATA BASE
REMOTE DATA BASE

FIG. 8

FIG. 9

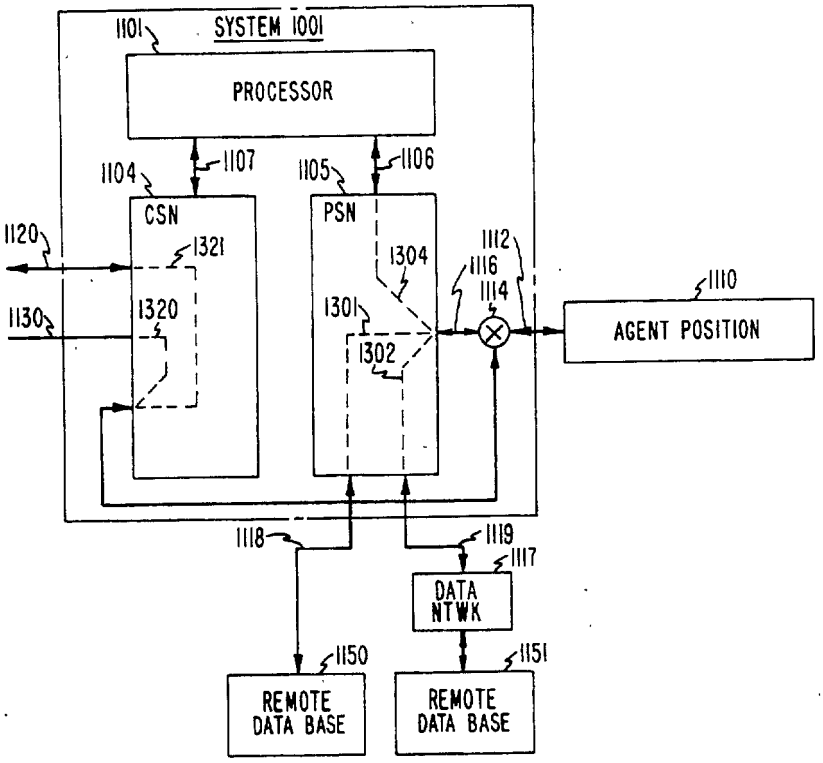

1101
SYSTEM 1001
PROCESSOR
1104
1107
1105
1106
CSN
PSN
1120
1321
1304
1112
1116
1114
1110
1130
1320
1301
AGENT POSITION
1302
1118
1119
1117
DATA NTWK
1150
1151
REMOTE DATA BASE
REMOTE DATA BASE

FIG. 10

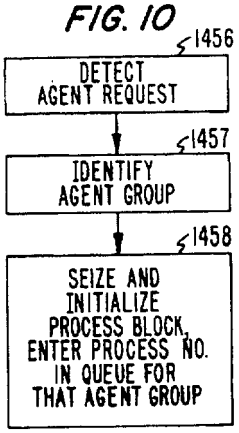

1456
DETECT AGENT REQUEST
1457
IDENTIFY AGENT GROUP
1458
SEIZE AND INITIALIZE PROCESS BLOCK, ENTER PROCESS NO. IN QUEUE FOR THAT AGENT GROUP

FIG. 11
QUEUE CONTROL AND QUEUE BLOCKS

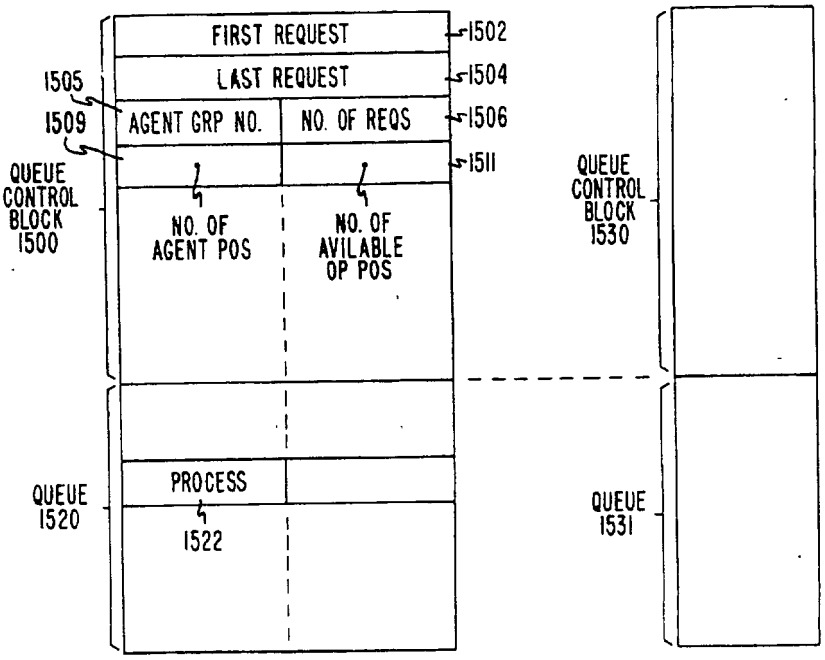


FIG. 12

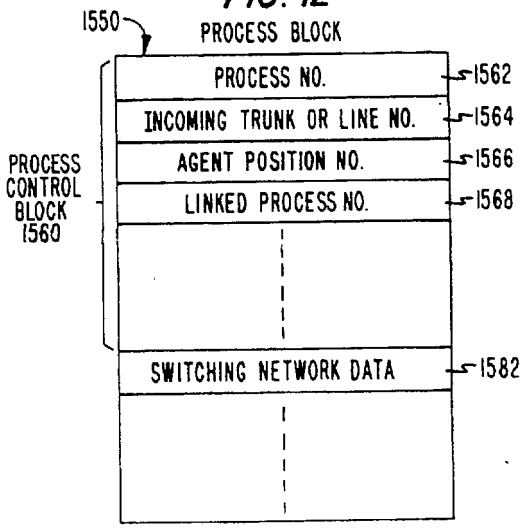


FIG. 13

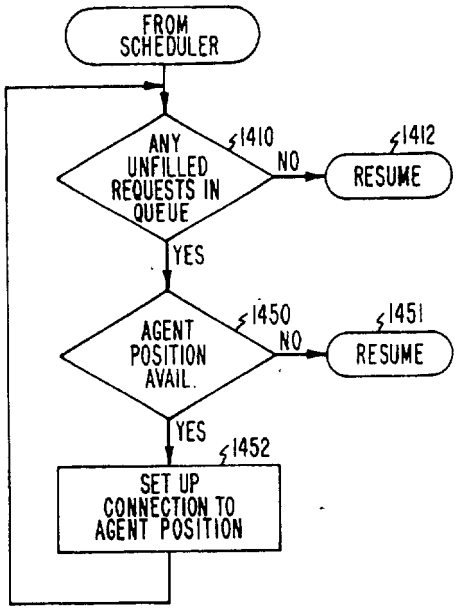
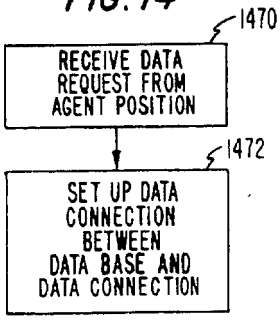

FROM SCHEDULER
ANY UNFILLED REQUESTS IN QUEUE
1410
NO
1412
RESUME
YES
AGENT POSITION AVAIL.
1450
NO
1451
RESUME
YES
1452
SET UP CONNECTION TO AGENT POSITION

FIG. 14


1470
RECEIVE DATA REQUEST FROM AGENT POSITION
1472
SET UP DATA CONNECTION BETWEEN DATA BASE AND DATA CONNECTION

OPERATOR COMMUNICATION ARRANGEMENTS FOR OPERATOR ASSISTANCE SYSTEMS

CROSS-REFERENCE TO RELATED APPLICATION

This application is related to the application of J. C. Dalby, Jr. and C. E. W. Ward, entitled "Agent Communication Arrangements for Telecommunications Systems" which application is assigned to the assignee of the present application, and is being filed concurrently herewith.

TECHNICAL FIELD

This invention relates to operator assistance systems used in telecommunication networks and specifically to an arrangement in an operator assistance system for providing integrated voice and data communications to operator positions.

BACKGROUND OF THE INVENTION

Modern telephone operator assistance systems automatically perform many of the functions required for completing customer-dialed operator assistance calls. The operation assistance system includes a switching network, a control processor and one or more operator positions. The processor typically accumulates data concerning a call and controls the display of that data on a terminal at the operator position. Using this data about the current state of a call, an attending operator communicates via a voice connection with the customer and keys additional call control and call record data into the terminal. The display control and call control data is sent between the operator position and the control processor used to control the switching network. In response to the keyed control data, the control processor effects call configuration changes, such as a call connection or disconnection, in the switching network, and records billing and other call record data.

Operator positions are connected to customers over a voice path. In the prior art, display and control data has been sent over a separate path between the operator position and the control processor. The use of such a separate control path makes it costly to locate operators far away from the switching network and control processor. Further, provision of modern operator assistance services frequently requires that the operators have access to remote data bases. Access to such data bases is provided over these separate paths via the processor of the operator switch, or via separate paths between the operator positions and the data bases. Such arrangements are slow and inefficient, and place a large and increasing data processing load on the control processor, limiting its capacity to serve operator assistance calls, or, alternatively, are inefficient in their use of data transmission facilities.

A recognized problem in the prior art, therefore, is the expense of locating operators far from their associated operator assistance systems and of locating small teams of operators in different remote sites. A further problem of the prior art is that no good arrangement exists for permitting operators to access a variety of data bases.

SUMMARY OF THE INVENTION

The aforementioned problem is solved and an advance is achieved in the art by providing an operator

position with integrated voice and data access through a communication facility, for carrying integrated data and voice signals to a switching network; the switching network switches the voice signals in a circuit switching network connectable to customer stations, and switches the data signals to a control processor of the operator assistance system through a packet switching network. At the operator position, the data input signal is used to receive data for generating a visual output, and the data output signals represent data generated from input by an operator at the operator position. Advantageously, the operator positions may be economically located remotely from the switching network at any convenient location such as a small service center or even a residence, since only a single facility is necessary for transmitting the integrated signal used for communicating with the operator positions.

In accordance with one aspect of the invention, the data signal from an operator position is switched in the packet switching network for further connection to one or more data bases. Advantageously, such an arrangement allows for rapidly changeable data connections between the operator position and a variety of data sources and data receivers.

In one specific embodiment of the invention, the operator position is connected to a switching network of an operator assistance system by a path carrying an integrated signal via a 64 kilobit B-channel and an associated 16 kilobit data channel or D-channel, such as the channels proposed for use in an Integrated Services Digital Network (ISDN). The B-channel is used for voice communications with customers and other operators and the D-channel is used for data communications with a processor of the operator assistance system or with one or more data bases, and for providing operator control of customer voice connections. The D-channel is switched via a packet switching network within the operator assistance system. The data from the operator position can be used to control the setup of customer connections, voice connections between the operator position and a customer station, and data connections between the operator position and a variety of data bases. A data network for accessing many data bases may also be connected to the packet switching network. Advantageously, such an arrangement is geared to be compatible in an economic manner with ISDN services and to communicate with other ISDN terminals and data bases. Advantageoulsy, a variety of data bases may be rapidly accessed from the operator position.

In one specific embodiment, the switching network includes a packet switching network, a circuit switching network, and multiplexors to integrate and separate data and voice channels for transmission to operator positions. Advantageously, this facilitates separate switching of voice and data channels to an operator position.

In one specific embodiment, the packet switching network includes protocol conversion facilities. Advantageously, this permits different protocols to be used for data communications among operator positions, data bases, and the control processor.

One specific embodiment of an operator position includes data input/output equipment, associated with a data channel, voice equipment associated with a voice channel, and a multiplexor/demultiplexor for integrating and separating the voice and data channels. The data channel is connected to a terminal processor for

controlling a visual display and for converting input signals from a keyboard into data and control messages. Advantageously, such an arrangement permits an operator to carry out the operator tasks efficiently by providing voice access to customers in conjunction with the data access to the appropriate data bases.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood from the following detailed description when read with reference to the drawing in which:

FIGS. 1 and 8 are system block diagrams of telecommunication systems;

FIGS. 2 and 9 are call configuration diagrams showing the various voice and data connections used in illustrative calls;

FIGS. 3 and 11 are memory layouts of queues used for storing customer requests;

FIGS. 4 and 12 are memory layouts of process blocks used for storing the data of calls; and

FIGS. 5–7, 10, 13, and 14, are a series of program flow diagrams illustrating the data processing and control functions for controlling illustrative calls.

DETAILED DESCRIPTION

FIG. 1 is a block diagram of an illustrative telecommunication system. FIG. 1 includes an exemplary embodiment of an operator assistance position or agent position. Operator assistance positions are used by telephone company attendant operators to help customers set up calls, record appropriate billing data, give directory assistance, etc. Agent positions are used by the employees of a business such as travel agents, order clerks, and airline reservation agents, to provide a service to their customers. Both agent positions and operator positions can be served by the system of FIG. 1.

In this detailed description, the use of an integrated signal for communication with one of these positions is illustrated with respect to calls to operator assistance positions and calls to agent positions. Both types of calls use the same principles of combining and separating voice and data channels, and switching the voice and data channels separately in a switching network. The two types of calls differ in that the data communications for an operator assistance call are predominantly between the operator position and a processor of the operator assistance system, whereas the data communications for an agent call are predominantly to one or more data bases not associated with an operator assistance or other telecommunications switching system. Both types of calls are described hereinafter.

Operator Assistance Calls

An operator assistance system serves operator positions and may also offer a variety of other services. FIG. 1 shows an operator assistance system 1 connected to a group of incoming lines 170, . . . , 171, connected to customers, or incoming trunks from other switching systems, or both, which are connected to ports 170A, . . . , 171A on a circuit switching network 154. Circuit switching network 154 may be any well known digital telecommunication circuit switching network. For convenience, lines, which are commonly two-way, and those trunks which are two-way, are designated as incoming or outgoing according to the function performed in a particular call. Circuit switching network 154 of operator assistance system 1 is also connected to a group of operator positions 160, . . . , 161 via interconnection paths 162, . . . , 163 that are connected to ports 162A, . . . , 163A on multiplexors 164, . . . , 165. Interconnection paths 162, . . . , 163 may use digital carrier facilities if the operator positions are physically remote from the switching networks. Also shown are outgoing lines or trunks 180, . . . , 181 connected to ports 180A, . . . , 181A on circuit switching network 154 of operator assistance system 1; outgoing trunks are also connected to other switching systems.

The ports are an interface between the switching network and connected transmission units such as customer lines, trunks to other offices, multiplexed transmission facilities, and data interfaces to data communication systems and to control processors. For a customer line, a port may be a line circuit which converts analog to digital signals, provides service request detection facilities and otherwise interfaces between the digital signals of a digital network and the analog signals of a conventional customer loop. For a trunk, the interface may be a facility interface with one channel of a frequency division multiplexed transmission facility. For use with time division multiplex facilities, such as the T1 carrier system manufactured by AT&T Technologies, Incorporated, or time division subscriber loop carrier systems, the port may directly interface a digital signal, carrying a number of time multiplexed channels, with the digital switching network.

The operator assistance and agent positions are arranged to work in an integrated services digital network (ISDN) environment. The concepts of ISDN have been extensively studied by the International Telegraph and Telephone Consultative Committee (CCITT) and are described, for example, in *International Tellecommunications Standrds: Issues and Implications for the* 80's—*A Summary Record of a July* 1982 *Workshop,* edited by D. M. Cerni and E. M. Gray and published in May, 1983, by the U.S. Department of Commerce (Document NTIA-SP-83-15).

The operator positions 160, . . . , 161 are compatible with ISDN and are referred to as ISDN terminals. ISDN terminals are arranged to receive and transmit a single digital signal, operating at 16, 80 or 144 kilobits per second (kb). The signal carries a "D-Channel" operating at 16 kb for the transmission of control and data packets, and zero, one or two "B-channels" operating at 64 kb each for the transmission of digitized voice or packetized or unpacketized higher speed data. In FIG. 1, the D-channels carrying data signals are switched by packet switching network 155, while the B-channels, carrying voice channels in this example, are switched by circuit switching network 154. The packet switching network 155 may be any well known packet switching network. The operator position communicates with the rest of the operator assistance system via an 80 kb integrated digital signal, comprising a B-channel and an associated D-channel.

In system 1, the 16 kb D-channels from packet switching network 155 and the 64 kb B-channels from digital circuit switching network 154 are combined in digital multiplexors 164, . . . , 165, which may be any well known digital multiplexor, and the integrated signal is routed from ports 162A, . . . , 163A over integrated data and voice interconnection paths 162, . . . , 163 to operator positions 160, . . . , 161. The integrated data and voice signals may be advantageously carried using a multiplexed digital transmission facility if the operator positions are located at a substantial distance from the switching networks.

Data packets from operator or agent positions may be of two types: control packets and data packets. Control packets can be used to transmit a request from an agent or operator position, for, for example, a change of the configuration of a call, such as the addition or disconnection of a port from a voice or data connection, to the control processor **151** used for controlling the system. Such a control packet is routed to the processor **151** which responds by sending proper control signals to the switching networks **154** and **155** to effect the requested action. Herein, both control and data packets are referred to as data or data packets.

Customers signal their requests by lifting their telephone receiver and by dialing. Such communication signals are detected in the circuit switching network **154**. The data representing these signals, such as a service request, is sent to processor **151** via control path **157**. Processor **151** responds by generating and sending the appropriate control signals to packet switching network **155** and circuit switching network **154** to effect the requested action.

In this description, networks **154** and **155** and the associated multiplexors such as **117**, **164**, . . . , **165**, **174**, and **215** are considered to be a network with ports such as **116A**, **149A**, **156A**, **162A**, . . . , **163A**, **169A**, **170A**, . . . , **171A**, **173A**, **180A**, . . . , **181A**, **213A**, and the capability for setting up circuit connections between those ports connected directly or through multiplexors to the circuit switching network **154**, and for setting up data connections between those ports connected directly or through multiplexors to packet switching network **155**. Some of the ports may carry multiplex signals from a plurality of lines, trunks, or positions.

Trunks from distant offices signal their requests either through signals on the trunk or through signals on a separate data facility, using common channel signalling, (CCS). CCS signals would also terminate on a port to the packet switching network (not shown). The signals from trunks and the CCS signals reflect data dialed by a customer, an operator, or an agent, and these, as well as the signals received directly from customers are referred to herein as communication signals.

The interconnection path **162** between operator position **160** and multiplexor **164** represents a path for carrying an integrated signal. Interconnection path **162** can be one of many paths being carried over a single multiplexed facility such as the T1 carrier system, previously cited. This is illustrated explicitly with respect to the group of operator positions **110**, . . . , **111**. These positions are connected by paths **112**, . . . , **113** to multiplexor **114** which is connected to interconnection path **116**, which is connected to port **116A** connected to multiplexor **117**. Multiplexor **117** is connected by path **123** to circuit switching network **154**, and is connected by path **125** to packet switching network **155**. In this illustration, paths **116**, **123** and **125** all carry signals for all of the operator positions **110**, . . . , **111**. Further, if desired, multiplexor **114** could generate two signals, representing a B-channel and a D-channel, to each of the operator positions **110**, . . . , **111** and thus eliminate the need for a separate multiplexor, such as multiplexor **209**, described below, inside each operator position.

FIG. **1** also shows an agent position **211** connected to system **1** via interconnection path **213** which is connected to port **213A**. Interconnection path **213** carries an integrated signal via a B-channel and an associated D-channel. These channels can be carried over path **213** using a multiplexed digital carrier facility in the same way as channels to operator positions can be carried over a multiplexed digital carrier facility. Multiplexor **215** connected to port **213A** combines the B-channel carried on path **219** from the connected circuit switching network **154** and the D-channel carried on path **217** from the connected packet switching network **155**. This allows the agent position **211** to communicate with operator assistance system **1** in the same way as operator positions **160**, . . . , **161**.

In this example, packet and circuit switching networks are used as shown in FIG. **1**. Alternatively, an integrated circuit and packet switching network for use in an ISDN, as described in the copending application by Beckner et al.: "Integrated Packet Switching and Circuit Switching System", Ser. No. 606,937, filed May 3, 1984, and assigned to the assignee of the present application, could be used in implementing the invention. Alternatively, a packet switching network capable of handling packetized voice as well as packetized data could also be used; in such a switch, the function of the circuit switching network **154** is carried out by a packet switching network.

Details of the operator position are illustrated in typical operator position **160** of operator assistance system **1**. As shown hereinafter in FIG. **8**, an exemplary agent position is similar. Entering operator position **160** is an 80 kb integrated voice and data signal on integrated voice and data interconnection path **162** from port **162A** on multiplexor **164**. Multiplexor **164** is connected to circuit switching network **154** via path **168** and packet switching network **155** via path **166**. The 80 kb combined digital signal comprises one 64 kb B-channel and one 16 kb D-channel. The B-channel is used for voice communications and the D-channel is used for packetized data communications. The 80 kb integrated voice and data signals enter the operator position **160** via interconnection path **162** at position multiplexor **209** which separates the D- and B-channel signals. The B-channel operator voice signal is routed from position multiplexor **209** via path **205** to a voice controller **206**, which handles such functions as echo suppression. The voice controller is connected to a bidirectional analog/digital converter **207**, which is connected to an operator headset **208** for generating acoustical outputs to and receiving acoustical inputs from an operator. The D-channel operator input data signal is routed from position multiplexor **209** via path **204** to terminal processor **201**. Terminal processor **201** generates signals to control voice controller **206**, and display **202** for generating visual outputs, and receives signals from a data input keyboard **203**, from which it generates operator data output signals to multiplexor **209**. Thus, an operator at operator position **160** has a voice connection through circuit switching network **154** to a customer via a B-channel, and a packet switched data connection through packet switching network **155** to processor **151**, or to a data communication path such as **147** or **169** (discussed below), via a D-channel. Since the voice and data communications between the operator position **160** and networks **154** and **155** are bidirectional, the multiplexor units **164** and **209** are also bidirectional multiplexor/demultiplexor units, and the A/D converter **207** is a combined analog/digital and digital/analog converter. The same is true for corresponding units associated with other operator positions and other ports of FIGS. **1** and **8**. For convenience, such multiplexor/demultiplexor units are called multiplexors herein.

In an alternative arrangement, the multiplexor 209, or the equivalent multiplexor 1209 of agent position 1110 (FIG. 8), may be physically located outside the operator or agent position, and the B-channel and D-channel signals fed directly into the position. This may be desirable, for example, if the interconnection path, such as path 116, carries signals on a multiplexed digital transmission facility and the function of the multiplexor is carried out by facility termination equipment, such as multiplexor 114. For clarity, operator or agent positions without such a multiplexor are called operator or agent communications equipment herein.

In another alternative configuration, the interconnection path 162 may be directly connected to a port on circuit switching network 154; the D-channel from the operator position is then switched in circuit switching network 154 for connection to a port on packet switching network 155.

The D-channel connected to an operator position is also advantageously used for accessing remote data bases, such as remote data base 150, accessed via packet switching network 155 and data communication path 169, connected to packet switching network interface port 169A. Remote data base 150 may contain data for indicating locations that are temporarily hard to reach through the public telephone network. Such a data base may be queried before setting up an operator assistance call. Alternatively, a remote data base 149 might be centralized for a region, and might be accessible via data communication path 147, connected to packet switching network interface port 147A, through a data network 148.

In order to control operator assistance calls, agent calls, and other calls, operator assistance system 1 is controlled by a stored program controlled processor 151. Processor 151 includes a central processing unit 152 and memory 153. Processor 151 communicates through data path 156 via packet switching network 155 with any of the operator positions 160, . . . , 161. Processor 151 controls circuit switching network 154 through control path 157, and packet switching network 155 through data and control path 156, connected to packet switching network interface port 156A. Processor 151 contains the programs outlined in the flow diagrams of FIGS. 5–7 and execute the appropriate ones in order to control the process of setting up circuit and data connections among customers, operator positions and data bases. Processor 151 which also communicates with an agent position 211 (FIG. 1) also contains the programs outlined in FIGS. 10, 13 and 14, for communicating with agent positions, although not every operator assistance system needs to contain these programs. Processor 151 and a comparable processor 1101 (FIG. 8) may be a multiprocessor system if high processing capacity or distributed processing is required.

In the case of an operator assistance request to be served by one of the operator positions 160, . . . , 161, a call such as a person-to-person call or calling card call is set up from one of the incoming lines or trunks 170, . . . , 171 to one of the outgoing lines or trunks 180, . . . , 181 before or after an operator assistance request has been served. Processor 151 routinely monitors these lines and trunks and controls circuit switching network 154 to make the necessary voice connections. In addition, when an operator assistance request is detected by processor 151, one of the operator positions 160, . . . , 161 is bridged onto the call connection or a connection is made between the operator position and an incoming line or trunk 170, . . . , 171, so that the operator may have a voice connection to the customer placing the call. The operator requests information from the customer and keys call control information into the system from the operator position. Thereafter, the operator position is disconnected from the call.

When the operator at operator position 160 is initially connected to a customer, an initial display control message from processor 151, sent via packet switching network 155 to the operator position, sets up the operator position display 202. This display could be any device having a controllable visual output, including a video terminal or a printer. The visual output informs the operator of the major details of the call so that the operator may interact verbally with the customer and receive additional information. The operator, using keyboard 203, then keys further data into the operator position. The terminal processor 201 converts this keyed input into a data message which is sent to processor 151 via packet switching network 155. Processor 151 may alter the configuration of the call (for example, by letting a person-to-person call complete to its destination) or may record information about the call (such as the calling card number of the calling customer) on the basis of the data keyed into the operator position by the operator.

An operator assistance call will now be described from the original request for operator assistance to the disconnection of the assisting operator position. In the first part of this description, the call will be described in terms of the call configuration and the memory changes made at various times. Thereafter, the flow of the program used to control the call configuration and the memory 153 of processor 151 is described. The call, whose configurations are illustrated in FIG. 2, is from an originating customer on incoming line 170 going to a terminating customer via outgoing trunk 180 using operator position 160 to assist in setting up the call.

A person-to-person call is used as an example. When this call is placed, the calling customer dials "0" followed by the directory number of the called customer. For this type of call, an operator assistance request is detected when the end of dialing has been recognized. Operator position 160 is connected to the incoming line 180 after the customer has finished dialing. Through verbal communications, the operator at operator position 160 finds out from the customer the call type (person-to-person) and the name of the requested called party. The operator then keys data into the keyboard 203 of operator position 160, which data when processed by terminal processor 201 and transmitted to processor 151 indicates that a connection should be set up between the calling and called customers while the operator remains connected. After the operator has verified that the requested called party is on the line, the operator keys further data into keyboard 203, which data when processed by terminal processor 201 and transmitted to processor 151, causes the processor to start charging for the call, and to bill the call as a person-to-person call. The operator at position 160 also signals to processor 151 to disconnect the operator position from the call.

FIG. 2 shows various voice and data connections of this call. When the customer has finished dialing and processor 151 has detected the operator assistance request implied by that completion of dialing, an operator position is connected to the incoming line. This connection is illustrated as being from line 170 via connection

321 in circuit switching network 154, thence via path 168 to multiplexor 164, to interconnection path 162, to operator position 160.

Subsequently, when the operator has indicated that the connection to the called customer is to be established, connection 323 between line 170 and outgoing trunk 180 is added to the existing connection 321 between line 170 and operator position 160. As previously mentioned, circuit switching network 154 described herein is a digital network. The operator assistance system is equipped with well known digital conference circuits, considered for clarity to be part of the circuit switching network, which allow three-way connections to be set up. This permits a third port, such as the port 180A to outgoing trunk 180, to be added to an existing connection.

In addition to the voice path between the incoming line and the operator position, described above, a data path to operator position 160 must be established. In the illustrated system, this data path includes a data connection 301 in packet switching network 155 between data path 156 to processor 151 and data path 166 between packet switching network 155 and multiplexor 164 leading via interconnection path 162 to operator position 160.

Processing of the exemplary call begins when a customer origination is initially detected for line 170. Under the control of processor 151, signaling information (the dialed number) is accumulated and stored in memory. When complete signaling information has been obtained, processor 151 recognizes that the assistance of an operator is required, and enters a request into a queue 420 (FIG. 3) in memory. Audible tone is sent back to the originating customer to let that customer know that a connection to an operator is being attempted.

At some later time, the queue 420 (FIG. 3) is examined by processor 151. Processor 151 sets up connection 321 (FIG. 2) in circuit switching network 154 between the incoming line 170 and operator position 160. Processor 151 sends an initial display control message, based on the data previously accumulated from and about the customer on line 170, through data connection 301 in packet switching network 155 to operator position 160 to control the display of initial call data on display 202 at that operator position. The operator at operator position 160 communicates with the customer on line 170 and uses keyboard 203 to key data which is processed by terminal processor 201 and transmitted to processor 151. Processor 151 records data about the call (such as a calling card number) or changes the configuration of the call (for example, by setting up the call to a distant switching system). At the end of the operator transaction, processor 151 disconnects operator position 160 from the connection to line 170, and updates its call records and makes any necessary billing entries in its memory.

Processor 151 contains a set of call processing programs, the pertinent ones of which are outlined in the program flow diagrams of FIGS. 5–7, for controlling operator assistance calls and operator assistance requests. In addition, each of processors 151 (FIG. 1) and 1101 (FIG. 8) contains a program called an operating system for controlling scheduling and the transmission and reception of messages among processes in one or more processors. Operating systems are well known and commonly used in the art. One such is the Duplex Multi-Environment Real Time (DMERT) operating system, described in Grzelakowski et al.: DMERT Operating System, *Bell System Technical Journal*, Vol. 62, No. 1, Part 2, January 1983, pp. 303–322. According to common practice in many operating systems, each job or process in a system is identified by a process number. Each active process has an assigned block of memory called a process block. The operating system maintains a list of all active process numbers and is able to find the location in memory of the process block for any process number. By using the program facilities of the operating system, a source process, residing in one processor, communicates with a destination process by sending a message, whose transmission and reception is handled by the operating system, to that destination process which may be resident in the same or a different processor.

Further details of the processing of the call can best be understood by reference to FIGS. 3–7 which show memory layouts and program flow diagrams. Queue 420 (FIG. 3) uses a well known fifo (first in, first out) queue discipline which has the characteristic that the most recently entered request will be the last to be served. Each request for a connection to an operator position is stored in the queue as a process number. This number acts as a link to a block of memory, called the process block, (described below with respect to FIG. 4), which contains all pertinent information about the process, in this case, an operator assistance call.

Each operator assistance system has one or more queues, each associated with a team of operator positions. FIG. 3 shows two such queues 420 and 431 each with its control block 400 and 430, respectively. Each queue is defined by a call type indicator 405, indicating the operator assistance request type. Different operator teams may serve different types of operator assistance requests. For example, a different team might be used for international calls than for toll and assistance calls within one country. Some teams may serve requests from more than one queue, although it is assumed for clarity herein that each operator team only serves one queue. Techniques for allotting operator positions from one team to more than one queue are well known in the art and are generally based on the principle of keeping delay, relative to a target maximum for each queue, equal in the several queues served by one team. The same principles can be applied to different teams of agents working for the same employer (sometimes serving requests from more than one queue) or different employers (each team serving requests from only one queue).

The queue control block 400 (FIG. 3) associated with queue 420 contains a first request indicator 402 and a last request indicator 404 to control the loading and unloading of the queue in a well known manner. It also contains a variable 406 indicating the number of entries in the queue. The queue control block also includes a call type indicator 405, described above. The queue control block also contains a count of the number of active operator positions 409 in the team that handles the call type of this queue control block: this count is incremented whenever an operator opens an operator position and decremented whenever an operator closes an operator position. The queue control block also contains a count of the number of available operator positions 411; this count is incremented whenever a position is released or opened, and decremented whenever a position is seized or closed. Each request in the queue, such as the request shown in queue 420, contains a pro-

cess number 422, which serves as a link to a process block, such as process block 450 (FIG. 4) containing call data for that request.

FIG. 4 shows a typical process block 450, one of many such that are present in a system when that system is processing many calls. Each process block contains pertinent information required to control a call. Such process blocks are used in prior art systems. Process control block 460, within process block 450, contains a process number 462, discussed above, used to identify the process. The process control block also contains the identification of the incoming trunk or line number 464; the associated operator position number 466; the number of any linked processes 468 (such as a process for controlling communications with remote data base 150); and a call type indicator 478. In addition, the process block contains general data about the call, such as billing data 480 and switching network data 482 which describes the call configuration.

FIGS. 5-7 are flow diagrams of programs for loading and unloading the queue, for responding to requests unloaded from the queue, and for responding to operator position requests. Requests are loaded into one of the queues 420, . . . , 431 (FIG. 3) when the call processing program detects an operator assistance request (action box 756, FIG. 5), and identifies the type of operator assistance request (action box 757). The call processing program then causes a request, comprising the number of the process controlling that call, to be loaded in the queue for that type of operator assistance request (action box 758, FIG. 5). The queue is selected on the basis of the call type indicator 478 stored in the process block 450 of the call; the call type indicator is changed as the customer provides information by dialing or as the customer provides information verbally to the operator and the operator keys that information into the system.

At some later time, determined by a scheduler that is part of the operating system, the queue 420 (FIG. 3) is tested in a conventional manner for a fifo queue (test 710, FIG. 6) to see if there are any requests in the queue. If not, other work is resumed (action box 712). Otherwise, test 750 which tests for availability of active, i.e., attended, operator positions, is carried out. A test for availability of an active operator position is similar to a test for availability of a trunk or service circuit; techniques for maintaining the status of such availability are well known in the art. If no positions are available, there is no need for further work on the queue at this time and other work may be resumed (action box 751); the queue will be reentered later under the control of the scheduler. If an active operator position is available, one of these positions is selected using well known allotment techniques. For example, the operator assistance position that has been idle for the longest time may be selected. A voice operator assistance connection to the requesting customer is set up, and an initial display control message is sent to the position from processor 151 (action box 752, FIG. 6). Subsequently, the queue processing loop is reentered at test 710 (FIG. 6).

In the example call being considered in this case, a person-to-person call, no connection has been set up from the originating customer to the terminating customer at the time the operator assistance request is recognized, so that the initial voice connection to the operator position is simply to the incoming line or trunk. However, in the case of other operator interventions such as an operator request for coin overtime deposit, a connection may already be established in which case the operator simply bridges onto that existing connection.

In the case of a person-to-person call such as the exemplary call, after the operator has communicated with the originating customer and recognized that a person-to-person call is to be set up, the operator keys a request asking that the call be set up and that the operator remain connected to the call after such setup. This request is processed by terminal processor 201 and sent to processor 151. The operator request is received in processor 151 system (action box 840 FIG. 7). The call is set up and the connection to the operator position controlling this call is retained (action box 844).

After the call from the calling customer to the called customer has been set up, which may require connections in other switching systems besides operator assistance system 1, the operator verifies that the requested called customer is now connected and that the person-to-person call has therefore been satisfactorily established. At this time, the operator keys a request, processed by terminal processor 201, to be disconnected from the customer connection and to start charging for the call. The response to the operator request is illustrated in FIG. 7 in the program sequence starting with action box 860 in which a processor receives this message. The operator position is disconnected (action box 863), and other records, such as the call records in the process block, and billing records are updated.

The arrangements described above (FIGS. 1-7) can also be used for a number of other services. FIG. 1 shows packet switching network 155 connected to a data communication path 169 which is connected to a remote data base 150. This data base 150 can then be accessed from operator position 160 via data connection 312 (FIG. 2) through packet switching network 155. For example, this data base might contain information about locations in a national public telephone network which are temporarily hard to reach. If a customer on incoming line 170 calls an operator on a 0- call (i.e., a call in which the customer only dials 0) and indicates that he has been having difficulty reaching another customer in a certain area, the operator can verify whether that area is temporarily inaccessible. If the area is not inaccessible, the operator can send a request to processor 151 to set up the connection between the two customers. In those circumstances, the customer is connected to operator position 160 via path 321 (FIG. 2) and the operator is connected through connection 312 in packet switching network 155 to data communication path 169 to the remote data base 150. Multiplexor 164 combines the voice signal from the customer on line 170 and the data signal from data communication path 169 to generate an integrated signal to operator position 160. Information carried by the data signal is used to control the operator position display 202 and the voice signal is used to communicate with the operator. Alternatively, the data base might be data base 149, accessed via data communication path 147 and data network 148 (FIG. 1).

The accessing of a data base is illustrated in the flow diagram of FIG. 7 starting with action box 880. An operator keys a request for data from a remote data base which is processed by terminal processor 201 and sent as a request message. This message is received by processor 151 (action box 880). Processor 151 sends a message conveying the request to remote data base 150 (action box 882) using data connection 303 in packet switching network 155 (FIG. 2). In order to permit the

response to be routed to operator position **160**, processor **151** sets up (action box **884**) a data connection **312** (FIG. **2**) between the data communication path **169** and data path **166** which leads to operator position **160**. Subsequently, the operator position receives a response from remote data base **150**, which response controls the operator position display **202** to give the operator the desired information. Alternatively, a data connection **312** could be set up directly between the operator position **160** and the remote data base **150** to handle both the request and the response if the packet switching network could respond directly to the request without requiring control data from processor **151**. A packet switching system such as the Packet Switching System 1 (PSSl) manufactured by AT&T Technologies, Incorporated, can respond directly to such requests.

In some cases, the customer will have an ISDN terminal. Such a customer is shown in FIG. **1** as appearing on line **173**. This customer terminates in operator assistance system **1** on port **173A** at a multiplexor **174**; the customer's B-channel (voice signal) is then directed over path **175** to circuit switching network **154** while his D-channel (data signal) is routed via path **176** to packet switching network **155**. This is shown diagrammatically in FIG. **2** in which customer **173** is routed to operator position **160** via data connection **328** through packet switching network **155** and is routed via connection **327** through circuit switching network **154**. Both the voice and data signal are routed to multiplexor **164** which is connected to the interconnection path **162** which connects the multiplexor **164** to multiplexor **209** of the operator position **160**. The data and voice connections may be made independently so that the customer on line **173** may only have a voice connection to operator position **160**; his data connection may be used for other purposes, for example, for signalling to processor **151**.

Operator assistance system **1** is also equipped with a protocol converter **158**. The protocol converter is shown as part of the packet switching network **155**. If, for example, the protocol used with data communication path **169** is different from the protocol used in the operator position or used by one of the ports connected to the operator assistance system, the protocol converter converts between the two protocols. Protocol converters are well known in the data switching art. For example, when the protocol of the operator position **160** does not match the protocol of the data communication path **169**, instead of using a packet switching network connection such as connection **312** (FIG. **2**) between the operator position and the data communication path **169**, data switching network connections **332** and **333** are used in order to insert protocol converter **158**. As another example, if the protocol of incoming line **173** does not match the protocol of the operator position, then the data signal on data path **176** from incoming line **173** is routed via data connection **331** in packet switching network **155** to protocol converter **158** and via data connection **332** from protocol converter **158** to multiplexor **164** for transmission to operator position **160**. While the protocol converter **158** is shown inside packet switching network **155** in this example, the protocol converter could also be located outside the packet switching network, for example, between packet switching network **155** and data communication path **169**.

An operator at an operator position can also request that a separate voice connection be set up, for example, to consult with another operator. This other connection, for example, to an outgoing trunk, such as outgoing trunk **181**, can be set up on the basis of a control message sent from the operator position **160** to processor **151**, via packet switching network **155**. The control processor controls the setting up of such a path and may either hold the original path to the customer or incoming line **170** or set up a three-way voice connection. The same types of arrangements can be used by agents at agent positions such as agent position **211**.

Agent Position Calls

FIG. **8** shows a telecommunication system **1001**, which may or may not also serve operator positions, for serving agent positions used by agents or clerks of a business. These agent positions may be used by an agent for, for example, taking orders. The methods of communicating with these agent positions are generally the same as those used for communicating with an assistance operator except that normally only operators may request certain changes in the configuration of a customer call. Further, the agent position communicates primarily with an external data base, whereas the operator position communicates primarily with a control processor. The customer communicates by voice with the agent who communicates via a data channel, in this case, a D-channel with the remote data base. For example, the agent may accept airline reservation orders verbally received from incoming customers, and the remote data base may be a data base used for such airline reservations.

System **1001** (FIG. **8**) is controlled by processor **1101**, which includes central processing unit (CPU) **1102** and memory **1103**. Processor **1101** communicates via control path **1107** with circuit switching network **1104** and via control and data path **1106**, connected to packet switching network interface port **1106A**, with packet switching network **1105**. Incoming lines **1120**, . . . , **1121** and outgoing lines **1130**, . . . , **1131** are connected to ports **1120A**, . . . , **1121A**, **1130A**, . . . , **1131A** of circuit switching network **1104**. Agent positions **1110**, . . . , **1111** are connected to packet switching network **1105** and circuit switching network **1104** via interconnection paths **1112**, . . . , **1113**, connected to ports **1112A**, . . . , **1113A**, which are connected to multiplexors **1114**, . . . , **1115**. Interconnection paths **1112**, . . . , **1113** are carried over interconnection facilities and may use multiplexed digital carrier systems if the agent positions are physically remote from the switching networks. The outputs of the multiplexors **1114**, . . . , **1115** are connected to the packet switching network **1105** and the circuit switching network **1104**. Processor **1101** contains programs for controlling actions such as the ones described with respect to FIGS. **10**, **13**, and **14**, and also contains an operating system.

FIG, **8** shows an exemplary agent position **1110**, also an ISDN terminal. Entering agent position **1110** is an 80 kb integrated voice and data signal on integrated voice and data interconnection path **1112** from port **1112A** on multiplexor **1114**. Multiplexor **1114** is connected to circuit switching network **1104** via path **1125** and packet switching network **1105** via path **1116**. The 80 kb integrated digital signal comprises one 64 kb B-channel and one 16 kb D-channel. The B-channel is used for voice communications and the D-channel is used for packetized data communications. The 80 kb integrated voice and data signals enter the agent position **1110** via interconnection path **1112** at position multiplexor **1209** which separates the D- and B-channel signals. The B-

channel agent voice signal is routed from position multiplexor 1209 via path 1205 to a voice controller 1206, which handles such functions as echo suppression. The voice controller is connected to a bidirectional analog/digital converter 1207, which is connected to an operator's headset 1208 for generating acoustical outputs to and receiving acoustical inputs from an agent. The D-channel agent data input signal is routed from position multiplexor 1209 via path 1204 to terminal processor 1201. Terminal processor 1201 generates signals to control voice controller 1206, and display 1202 for generating visual outputs, and receives signals from a keyboard 1203, from which it generates agent data output signals to multiplexor 1209. Thus, an agent at agent position 1110 has a voice connection through circuit switching network 1104 to a customer via a B-channel, and a packet switched data connection through packet switching network 1105 to processor 1101, or to a data communication path such as 1118 or 1119, via a D-channel. In some cases, it may be desirable to locate the multiplexor 1209 outside the agent position. This may be economical where a group of agent positions are connected to the telecommunication switching system by a shared multiplexed facility. For clarity, an agent position without a multiplexor such as position multiplexor 1209 is referred to herein as agent communication equipment.

The interconnection path 1112 between agent position 1110 and multiplexor 1114 represents a path for carrying a combined signal. Interconnection path 1112 can be one of many paths being carried over a single multiplexed facility. This is illustrated explicitly with respect to the group of agent positions 1160, . . . , 1161. These positions are all connected by paths 1162, . . . , 1163 to multiplexor 1164 which is connected to interconnection path 1166, connected to port 1166A, which is connected to multiplexor 1167. Multiplexor 1167 is connected by path 1173 to circuit switching network 1104, and is connected by path 1175 to packet switching network 1105. In this illustration, paths 1166, 1173 and 1175 all carry signals for all of the operator positions 110, . . . , 111. Further, if desired, multiplexor 1164 could generate two signals representing a B-channel and a D-channel to the agent communication equipment, and thus eliminate the need for a separate multiplexor such as multiplexor 1209 inside each agent position.

The packet switching network 1105 is also connected to remote data bases 1150 and 1151 via data communication path 1118 and via data communication path 1119 and data network 1117. Data network 1117 may be a public data network such as the General Telephone and Electric Telenet Network. Many data bases may be connected to such a network.

Protocol conversion circuit 1108 can be used if necessary to convert between the data protocol used by the agent positions 1110, . . . , 1111 and the data protocol used for communicating, over data communication path 1118, connected to packet switching network interface port 1118A, or data communication path 1119, connected to packet switching network interface port 1119A for data network 1117, with the remote data bases 1150 or 1151.

FIG. 9 shows the call configuration of an agent call set up using the system of FIG. 8. A customer on line 1120 wishes to communicate with a travel agent at one of the agent positions 1110, . . . , 1111. The processor 1101 recognizes the request (action box 1456, FIG. 10), identifies the agent group of the request (action box 1457), seizes and initializes a process block for that call and enters the process number of that process block in the queue for that agent group (action box 1458).

The queue (FIG. 11) and process block (FIG. 12) for agent calls are similar to the queue (FIG. 3) and process block (FIG. 4) used for operator assistance calls. Queue 1520 (FIG. 15) stores in each entry 1522 the process number of the process block which contains data describing the recognized request. The control block 1500 for queue 1520 contains pointers to the first request in the queue 1502, last request 1504, an identification of the agent group number 1505 (comparable to the type of operator assistance request 405 of FIG. 3), the number of requests in the queue 1506, the number of active agent positions 1509 for serving requests in the queue, and the number of those agents now available 1511 to service requests. A plurality of queues 1520, . . . , 1531, each with its own control block 1500, . . . , 1530, is served by each telecommunication switching system such as system 1001. Should it be found desirable to overflow requests from one queue to another, or from agents connected to one system to those connected to another, the same types of arrangements previously described with respect to operator assistance traffic can also be used.

Process control block 1560 (FIG. 12) of process block 1550 records the process number 1562 for identifying the agent call process, the incoming line or trunk 1564 of that call, the agent position number 1566, and a linked process number 1568 such as that of a process for communicating with a data base accessed by the agent. The process block 1550 also contains the necessary switching network data 1582 for describing and controlling the configuration of the agent call plus any other data necessary for communications among agent, customer, and one or more data bases.

Sometime after the agent request has been recognized and entered into queue 1520, the scheduler of the operating system of processor examines the queue for unfilled requests (test 1410, FIG. 13). If no unfilled requests are in the queue, other work is resumed (action box 1412). Otherwise, a check is made (test 1450) by examining data item 1511 of queue control block 1500 (FIG. 11) to see if any agent positions are available in that group. If not other work is resumed (action box 1451). If at least one active (attended) agent position is available, say position 1110, an agent position is selected from the available agent positions and a voice connection is set up to that agent position (action box 1452). The connection is shown in FIG. 9 as connection 1321 through circuit switching network 1104, which connects the customer on line 1120 to multiplexor 1114, to interconnection path 1112 to agent position 1110.

The attending agent at selected agent position 1110 can now communicate verbally with the customer. In response to the customer's requests, the agent can generate a message to request a data connection 1301 through packet switch network 1105 to data communication path 1118 to remote data base 1150, for example, to query an airline reservation data base for flight availability. Message exchanges for accessing data bases are well known in the art and will not be further described herein. Based on the data messages exchanged between the agent position and the remote data base 1150, the agent may further communicate with the customer, for example, to convey flight availability data; if necessary,

the agent may send further messages, such as an airline reservation request to the data base **1150**.

Subsequently the agent may wish to communicate with remote data base **1151**, for example, to make a hotel reservation. A data connection **1302** is now set up through packet switching network **1105** to data communication path **1119** to data network **1117** to remote data base **1151**. Again, the agent first queries the data base for availability of a hotel reservation, communicates verbally with the customer, and, if necessary, sends further messages, such as a hotel reservation request to data base **1151**.

Agent position **1110** may also communicate with processor **1101** through connection **1304** in packet switching network **1105**, and through data path **1106**. This data connection is used for requesting processor **1101** to set up a connection to one of the remote data bases **1150** and **1151**, or to add a connection **1320** to some other source of verbal information, such as a remote agent connected via an outgoing line or trunk **1130**, or to disconnect and/or make unavailable the agent position **1110**.

Under this type of arrangement, interconnection path **1112** transmits an integrated voice and data signal carrying a B-channel and a D-channel. The agent at the agent position **1110** communicates verbally with the customer via the B-channel and the voice connection set up through circuit switch network **1104**, and with the remote data bases **1150** and **1151** through the D-channel and the data connection set up via interconnection path **1112**, multiplexor **1114**, path **1116**, and data connections **1301** and **1302** in packet switching network **1105** to the data communication paths **1118** and **1119** leading to the remote data bases **1150** and **1151**. The specific remote data base and the data communication path, and, if necessary, data network leading to that data base can be selected under the control of processor **1101**, accessed by agent position **1110** through data connection **1304**.

FIG. **14** shows the actions required by the processor **1101** for selecting an appropriate data base. The processor **1101** receives a request via data connection **1304** (FIG. **9**) from the agent position such as position **1110** (action box **1470**, FIG. **14**). Based on this request, the processor **1101** sets up a data connection, such as connection **1301** to a remote data base, such as data base **1150** (action box **1472**). When a change of data base is required, the agent sends a new request to the processor **1101** which selects the new data base in response to that new request.

Alternatively, if the packet switching network **1105** has the appropriate facilities, the data base can be selected directly under the control of the data message that is generated by the agent position. For example, a packet switch network such as the Packet Switch System number **1** (PSS **1**, previously cited) has the capability for recognizing destination addresses directly.

The above description is considered to be only an illustrative embodiment of the invention, plus a number of suggested alternatives in parts of the embodiment. Other alternatives are possible without departing from the spirit of the invention. For example, if substantial amounts of data need to be exchanged between agent or operator positions and a data base, the second B-channel provided with full ISDN service may be utilized for this purpose. This B-channel can also be used for data communications with a customer, such as the ISDN customer on line **173**, by attaching an output path (not shown) carrying the second B-channel to multiplexor **174** (FIG. 1), and connecting that output path to packet switching network **155** for high speed packetized data, or to circuit switching network **154** for circuit switched data. The second B-channel can also be used for data messages, while the D-channel is used for control messages, such as many of the messages sent to the control processor. It is to be understood that various and numerous other arrangements may be devised by one skilled in the art without departing from the spirit and scope of the invention. The invention is thus limited only as defined in the accompanying claims.

What is claimed is:

1. An operator assistance system comprising:

operator position means, responsive to integrated voice and data input signals for generating acoustical outputs and visual outputs to an operator, and responsive to acoustical inputs and data inputs from an operator for generating integrated voice and data output signals;

switching network means comprising a plurality of ports connectable to customer stations;

interconnection means connected to said operator position means and said switching network means for transmitting said integrated input signals and said integrated output signals between said operator position means and said switching network means; and

control processor means, connected to said switching network means, for generating control signals for controlling said switching network means, and for generating data signals for transmission to said switching network means;

wherein said switching network means comprises switch multiplexing means responsive to said integrated output signals for generating output data signals and output voice signals, circuit switching means responsive to said control signals for transmitting voice signals received on one of said plurality of ports to said switch multiplexing means, and packet switching means resnonsive to said control signals for transmitting data signals received from said control processor means to said switch multiplexing means, wherein said switch multiplexing means is further responsive to said transmitted data signals and said transmitted voice signals for generating said integrated input signals, wherein said circuit switching means is further responsive to said control signals to transmit said output voice signals to said one of said plurality of ports, and wherein said packet switching means is further responsive to said control signals to transmit said output data signals to said control processor means; and

wherein said control processor means is responsive to said output data signals to generate said control signals.

2. An operator assistance system comprising:

operator position means, responsive to integrated voice and data input signals for generating acoustical outputs and visual outputs to an operator, and responsive to acoustical inputs and data inputs from an operator for generating integrated voice and data output signals, wherein said operator position means comprises position multiplexing means, and operator communication means comprising acoustical conversion means responsive to operator voice input signals and said acoustical inputs, respectively, for generating said acoustical outputs

and operator voice output signals, respectively, and input/output means responsive to said data inputs from an operator for generating operator data output signals, and responsive to operator data input signals for generating said visual outputs, and wherein said position multiplexing means comprises means responsive to said integrated input signals for generating said operator voice input signals and said operator data input signals, and responsive to said operator data output signals and said operator voice output signals for generating said integrated output signals;

switching network means comprising a plurality of ports connectable to customer stations;

interconnection means connected to said operator position means and said switching network means for transmitting said integrated input signals and said integrated output signals between said operator position means and said switching network means; and

control processor means, connected to said switching network means, for generating control signals for controlling said switching network means, and for generating data signals for transmission to said switching network means;

wherein said switching network means comprises switch multiplexing means responsive to said integrated output signal for generating output data signals and output voice signals, circuit switching means responsive to said control signals for transmitting voice signals received on one of said plurality of ports to said switch multiplexing means, and packet switching means responsive to said control signals for transmitting data signals received from said control processor means to said switch multiplexing means, wherein said switch multiplexing means is further responsive to said transmitted data signals and said transmitted voice signals for generating said integrated input signals, wherein said circuit switching means is further responsive to said control signals to transmit said output voice signals to said one of said plurality of ports, and wherein said packet switching means is further responsive to said control signals to transmit said output data signals to said control processor means.

3. The operator assistance system of claim 2 wherein said input/output means comprises:

data input means for generating first intermediate signals;

a terminal processor responsive to said first intermediate signals for generating said operator data output signals and responsive to said operator data input signals for generating second intermediate signals; and

visual output means responsive to said second intermediate signals for generating said visual outputs.

4. The operator assistance system of claim 3 wherein said interconnection means comprises an integrated transmission facility and said integrated input signals and said integrated output signals are transmitted via a B-channel and the associated D-channel of said integrated transmission facility.

5. The operator assistance system of claim 4 wherein said packet switching means further comprises protocol conversion means for converting between different protocols of said data signals generated by said control processor means and of said data signals transmitted to said switch multiplexing means.

6. The operator assistance system of claim 4 wherein said integrated transmission facility comprises a multiplexed transmission facility for transmitting a plurality of B-channels and D-channels.

7. The operator assistance system of claim 4 wherein said control processor means is responsive to said output data signals from said packet switching means to generate control signals to control said circuit switching means to set up a voice connection between two of said ports.

8. The operator assistance system of claim 7 further comprising data communication means connected to said packet switching means wherein said packet switching means is further responsive to control signals from said control processor means to transmit data signals received from said data communication means to said switch multiplexing means, and to transmit said output data signals from said switch multiplexing means to said data communication means.

9. The operator assistance system of claim 8 wherein said packet switching means further comprises protocol conversion means for converting between different protocols of said output data signals from said switch multiplexing means and the data signals transmitted to said data communication means.

10. The operator assistance system of claim 8 wherein said data communication means is connected to a data network.

11. The operator assistance system of claim 10 wherein said data network is connected to a data base.

12. The operator assistance system of claim 11 wherein said integrated transmission facility comprises a multiplexed transmission facility for transmitting a plurality of B-channels and D-channels.

13. The operator assistance system of claim 8 wherein said data communication means is connected to a data base.

14. The operator assistance system of claim 13 wherein said integrated transmission facility comprises a multiplexed transmission facility for transmitting a plurality of B-channels and D-channels.

15. The operator assistance system of claim 4, wherein said control processor means is responsive to said output data signal from said packet switching means to generate control signals to control said circuit switching means to set up a voice connection between another of said ports and said switch multiplexing means.

16. The operator assistance system of claim 1, wherein a subset of said ports receive communication signals, wherein said circuit switching means transmits data signals representing said communication signals to said control processor means, and wherein said control processor means is responsive to said data signals representing said communication signals and to said output data signals from said packet switching means to generate said control signals.

17. An operator assistance system comprising:

switching network means, comprising a plurality of first ports for the transmission of voice signals to and the reception of voice signals from customer stations, and second ports for the transmission of integrated voice and data input signals to and reception of integrated voice and data output signals from operator positions; and

control processor means, connected to said switching network, for generating control signals, for gener-

ating and transmitting data signals, and for receiving data signals;

wherein said switching network means comprises switch multiplexing means connected to one of said second ports responsive to integrated output signals from said one of said second ports for generating output data signals and output voice signals, circuit switching means connected to said first ports responsive to said control signals for transmitting voice signals received on one of said first ports to said switch multiplexing means, and packet switching means responsive to said control signals for transmitting data signals received from said control processor means to said switch multiplexing means, wherein said switch multiplexing means is further responsive to said transmitted data signals and said transmitted voice signals for generating integrated input signals to said one of said second ports, wherein said circuit switching means is further responsive to said control signals to transmit said output voice signals to said one of said plurality of first ports, and wherein said packet switching means is further responsive to said control signals to transmit said output data signals to said control processor means; and

wherein said control processor means is responsive to said output data signals to generate said control signals.

18. The operator assistance system of claim 17 wherein said one of said second ports is adapted to be connected to an integrated transmission facility comprising a B-channel and an associated D-channel.

19. The operator assistance system of claim 18 wherein at least one of said plurality of second ports comprises means for combining a plurality of B-channels and a plurality of D-channels.

20. An operator assistance comprising:

a plurality of ports connectable to customer stations;

operator communication means comprising voice access means and data access means for communicating with an assistance operator;

control processor means for generating processor control signals for controlling a switching network;

a switching network connected to said control processor means and to said plurality of ports; and

interconnection means for connecting said operator communication means to said switching network comprising a B-channel for transmission of voice signals and an associated D-channel for transmission of data signals between said operator communication means and said switching network, and position multiplexing means cooperating with said operator communication means for connecting said B-channel to said voice access means and said associated D-channel to said data access means;

wherein said switching network comprises circuit switching means responsive to said processor control signals for connecting said B-channel to one of the ports connected to switching network, and packet switching means responsive to said processor control signals for connecting said associated D-channel to said control processor means; and

wherein said control processor means is responsive to signals on said associated D-channel to generate said processor control signals.

21. The operator assistance of claim 20 wherein said switching network further comprises switch multiplexing means for transmitting said associated D-channel between said packet switching means and said interconnection means, and for transmitting said B-channel between said circuit switching means and said interconnection means.

22. The operator assistance system of claim 21 wherein two of said ports are connected to said circuit switching means and wherein said control processor means is responsive to said data signals received on said associated D-channel to generate processor control signals to control said circuit switching means to set up a connection between said two of said ports connected to said circuit switching means.

23. The operator assistance system of claim 22 further comprising data communication means connected to said packet switching means for communicating with a data base, wherein said packet switching means is further responsive to said processor control signals for connecting said associated D-channel from said switch multiplexing means to said data communication means.

24. In an operator assistance system for interconnecting a first and a second telephone customer station and a telephone operator position, comprising control processor means and switching network means for interconnecting said customer stations, said control processor means, and said operator position, a method of setting up an operator assistance call between said first customer station and said second customer station comprising the steps of:

receiving communication signals from said first customer station;

responsive to receipt of said communication signals, setting up a voice path, between said first customer station and said operator position, comprising a voice connection in said switching network means and a B-channel of an integrated voice and data facility interconnecting said switching network means and said operator position, and setting up a data path, between said control processor means and said operator position, comprising a data connection in said switching network means and a D-channel associated with said B-channel in said integrated facility;

sending an initial display control message from said control processor means through said switching network means to said operator position over said data path;

receiving a data message in said control processor means over said data path from said operator position;

responsive to receipt of said data message, setting up a voice connection in said switching network means from said first customer station to said second customer station.

25. In the operator assistance system of claim 24 wherein said operator assistance system further comprises data communication means, connected to said switching network and to a data base, the method of claim 24 further comprising the steps of:

receiving a first other data message in said control processor over said data path from said operator position;

responsive to said first other data message, setting up an other data path, between said data communication means and said operator position, comprising an other data connection in said switching network and said D-channel;

receiving a second other data message from said operator position over said D-channel and transmitting said second other data message through said other data connection via said data communication means to said data base; and

receiving a third other data message from said data base via said data communication means and transmitting said third other data message to said operator position through said other data connection over said D-channel.

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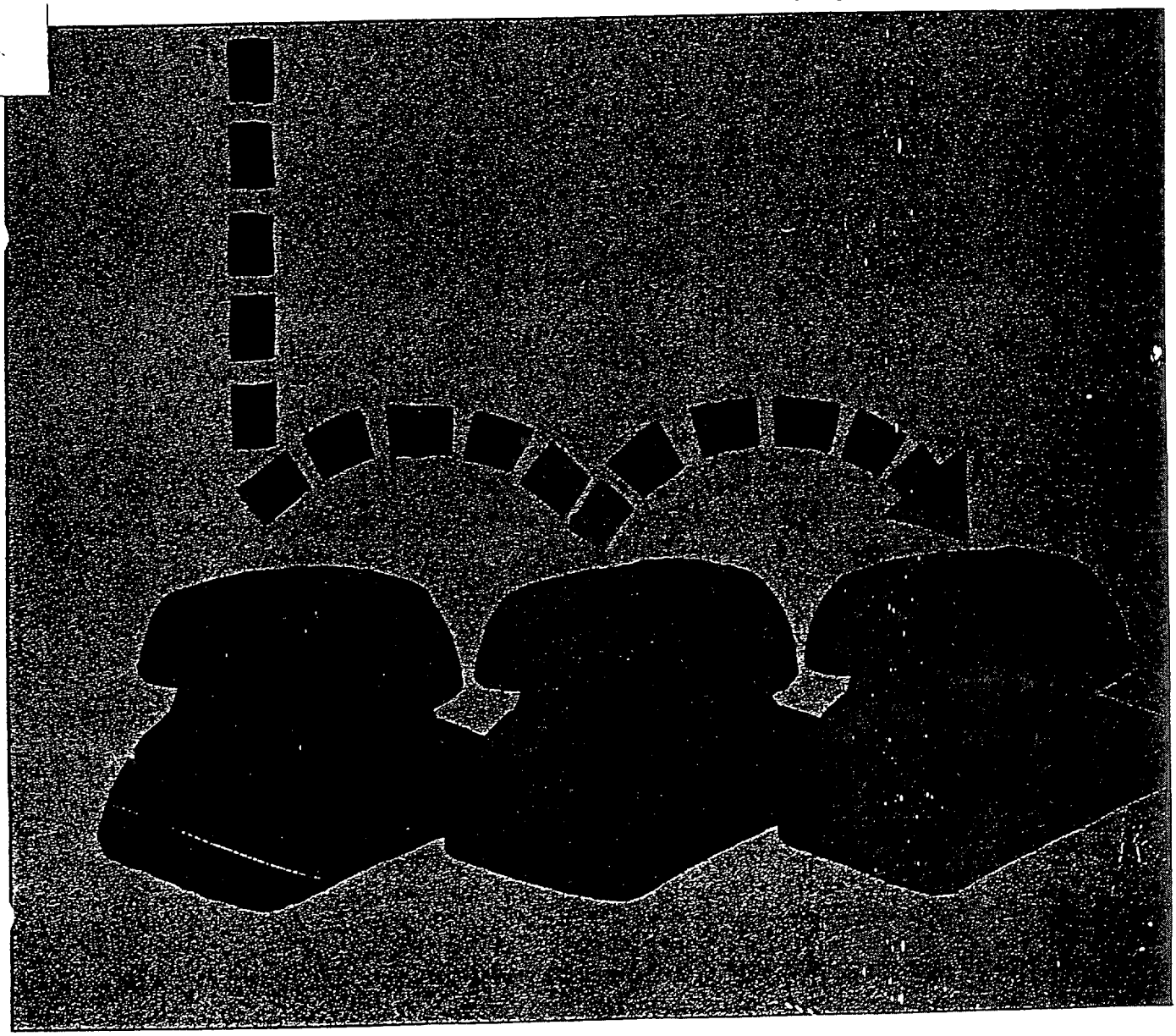
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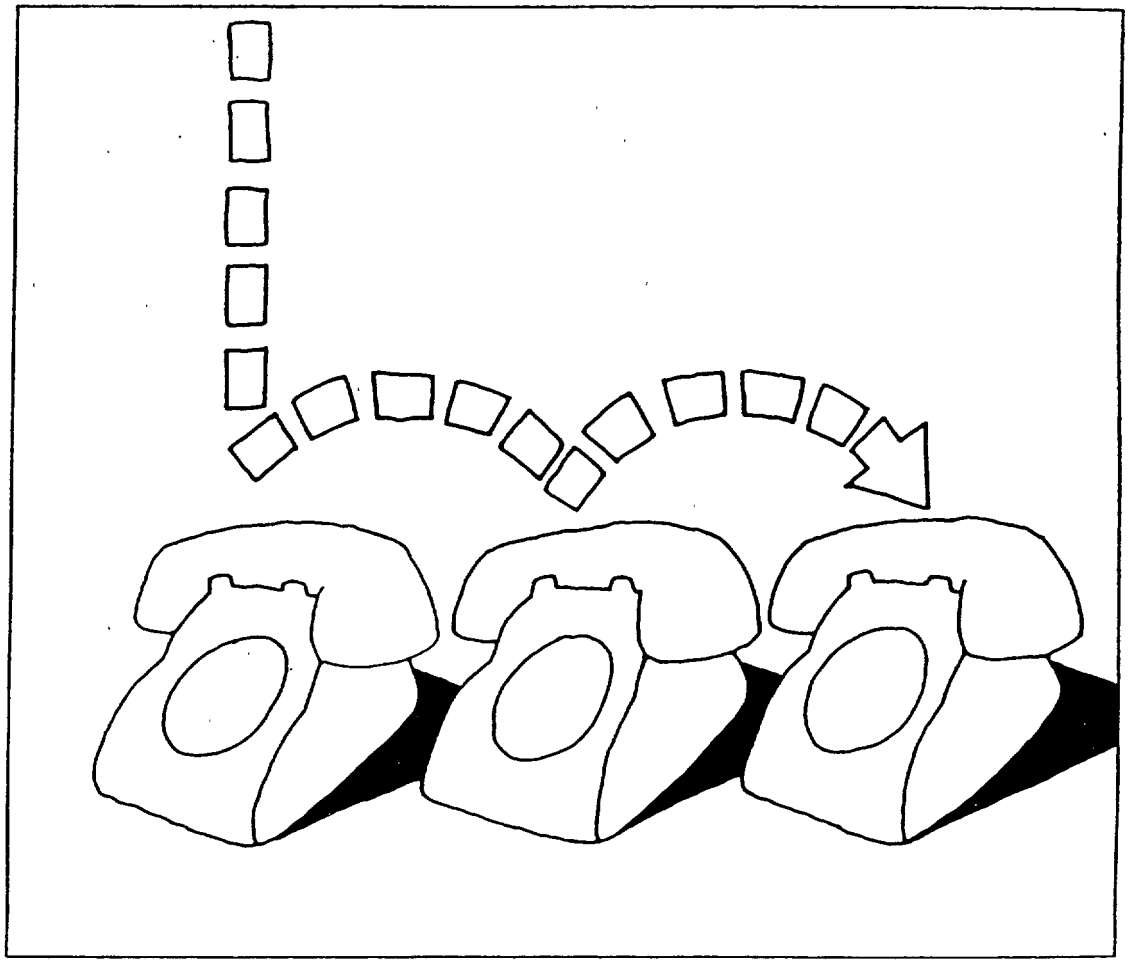
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Preface to the Second Edition

In the four years since publication of A Management Guide to Automatic Call Distributors both the importance and the sophistication of automatic call distributors have increased dramatically. The response to the first edition of this book is evidence of an accelerating trend. The numerous factual changes in the second edition and the expansion of technical detail in several chapters were necessitated by the evolution of a more knowledgeable and eager audience demanding an in-depth understanding of the current generation of equipment.

During this period the communications industry was radically altered by the Justice Department's imposition of divestiture and the increasingly laissez faire posture of the Federal Communications Commission. At the same time the telecommunications community is finally beginning to enjoy some of the technological innovations which have been common in data processing for the last five years. Divestiture brought with it not only tremendous confusion and a degradation of service levels; it also encouraged the release of communications technology which will change the basic capabilities of this industry.

Many of the forces set in motion over the last few years will ultimately result in greatly reduced communication expenses for businesses, along with a wide range of benefits to consumers.

The demand for sophisticated products in the ACD marketplace has driven the manufacturers to create new features and develop new products. Since the first ACD's were introduced, users have prodded and dragged the manufacturers to this marketplace. All of the data had suggested that the demand was too shallow to justify a major investment.

It is now obvious that the ACD marketplace itself is largely untapped. There are vast numbers of salesmen well-versed in the functional and economic advantages of key systems and PABX's who are discovering the opportunities for themselves and their customers offered by ACD's. There are still few salesmen who fully understand the ACD environment and sell the profit potential of these machines. In the future, the ACD will become as much a part of corporate information systems as the mainframe computer is today.

In recent months Northern Telecom has established itself as a viable competitor to Rockwell International for the large systems ACD marketplace. This is a market niche which Rockwell held unchallenged for over a decade. It is now wide open because of the growing perception that there is a very large and elastic demand curve for ACD functions. Teknekron, IBM-Rolm, and other manufacturers are developing advanced features which will make the current generation of ACD equipment obsolete and greatly increase the number of possible applications. Hopefully, this book will accelerate the cycle of change and improvement in ACD products.

This second edition is designed so that readers can choose the sections most applicable to solving their immediate problem--be it buying an ACD, staffing, or establishing performance parameters. The book is written with the telecommunications professional in mind and will not provide light reading for the interested amateur. Telecommunications as a discipline is now just as demanding as the data processing profession and requires a similar level of scientific knowledge and professional dedication. A telecommunications professional of ten years past may have been quite competent with a general knowledge of business goals. Now, however, that knowledge must be combined with skills in electronic engineering, mathematics, programming, and practical telephony. This book offers information about the fundamental skills required to operate an ACD center successfully, but it must be supplemented by the continued analysis and critical evaluation of the operating ACD itself.

Part I, the Introduction, outlines the elements which comprise an ACD and the diverse factors which influence its operation. Parts II and III should be used to assist a manager who is either buying a new ACD or re-evaluating the present system. In Part IV the elementary concepts needed for a technical analysis of the ACD in terms of its economic performance and traffic engineering are discussed. Service level definition is covered, as well as application of that service level to the problems of trunking and staffing. In addition, some consideration is given to multi-node ACD's and the problems of tandem trunking and overflow/interflow circuits. Part V applies the theoretical foundations of earlier sections to the actual operation of an ACD center. The organization of the system center, the staff management, and the agent operations are all considered as an extension of the performance parameters. The call-handling capability of the ACD is

discussed in Part VI; reports are covered in a detailed analysis of Administrative Data Systems and the essential reporting functions. Some elementary computer forecasting programs are offered that will run in BASIC on a desk-top microcomputer.

We want to thank the many intelligent and patient marketing representatives and technical advisors from the various vendors who assisted us in the publication of this work through their documents, questions, and suggestions. Our debt to a variety of authors is evident and their works are noted in the bibliography. Much credit should be given to the ACD managers around the country whose efforts continually improve our communications facilities.

We dedicate this book to a vital and vigorous industry and to our equally flourishing daughter, Yvette Elizabeth Grant.

Steven C. Grant
Yvonne Brooks Grant
January, 1985

A MANAGEMENT GUIDE TO AUTOMATIC CALL DISTRIBUTORS

PART I

INTRODUCTION

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INTRODUCTION

The central philosophy behind this book is that an ACD must be managed in a fundamentally different style than any other communications device. Like all other communication services, the pivotal criterion by which to judge an ACD is the service level. Unlike these devices, the ACD can be managed with a service level rationally determined by the application of standard economic analyses. The service level in a PABX, or a tandem toll center, is basically determined by the psychological perception of the users.

With ACD's, since they are revenue-producing funnels for the flow of consumer information and services, it is possible to determine a scientific service level. This level is related to user perceptions, but is based on an economic analysis of the marginal productivity (or incremental profit) from any given level of blockage within the ACD center.

An ACD is more complicated to manage than other communication devices because its operation must be tuned in response to even short variations in staffing and call volumes. These fluctuations profoundly affect so many different aspects of an ACD-based business that it requires day-by-day, hour-by-hour analysis and management judgement in order to operate at an optimal level. It is never adequate to staff an ACD only for a peak period like a PABX, or to configure the number of trunks simply based on the average hours of highest traffic load like a tandem switch (not related to Tandem Computers). The ACD's proper role is not to offer any arbitrary service level selected at random, but to perform consistently at a service level which will generate profit or save money for the profit center.

This book defines the various aspects of an ACD center and provides the manager with a philosophy of management based on the unique requirements of these powerful and immensely profitable machines.

The Automatic Call Distributor (ACD) is the single most important cost-saving, revenue-producing communications tool available to the manager of an incoming call center.

The ACD is engineered to handle a large volume of incoming calls as efficiently and economically as possible. It is designed to answer calls efficiently by distributing the workload on an equitable basis throughout the agent staff. Whenever a modern ACD is installed, the speed, efficiency, and management control usually results in a twenty to forty percent increase in the productivity of the agent force and a ten- to twenty-second decrease in the average speed of answer.

These numbers translate into substantial savings and very short payback periods for the ACD investment. The current AT&T Communications WATS tariff costs around thirty cents per minute. The average value of the products sold in a telemarketing center can range from $ 15.00 to $50.00 per minute.

The ACD performs its functions more economically than any other device for three simple reasons.

1. A waiting queue is provided to increase the effective arrival rate of the incoming calls and allow more minutes of productive time for each agent and each telephone line.

2. The workload is automatically distributed among the work force to allow an equitable assignment of duties, which in turn facilitates greater productivity.

3. Comprehensive management reports are provided to allow control of the assignments, agents, and lines in a rational manner.

The ACD is the most complicated of any communications switch because it requires extensive reporting features and call-handling capabilities. The functional requirements of a PABX or a tandem switch are relatively simple compared to the Automatic Call Distributor.

The ACD is becoming increasingly important to the incoming call center manager.

1. It provides a cost-effective solution to the rising costs of consumer marketing.

2. It is a fully manageable utility which forces peripheral functions into a tightly controlled environment.

3. It is identifiable to upper management as a communications profit center.

The ACD has come of age as the center of the electronic shopping center. The incoming call center now combines the direct sale and voice referral capabilities of highly trained agents with the automatic interfaces of Audio Response Systems and Point-of-Sale devices.

The ACD stands at the helm of the telemarketing industry--complete with datalinks to computer systems which automatically flash the screen desired by the agent before the call arrives. Automated outbound marketing software dials a list of customer contacts for the agent, recognizes a human answer, and speeds up the distribution of calls. Specialized software installed by AT&T Communications and the Bell Operating Companies can now provide the agent with the WATS telephone number dialed by the caller.

Because of these technical enhancements and increasing sophistication in the management and operation of ACD centers, it is essential to consider the application of these devices in any business process which involves a large volume of incoming or outgoing calls.

The ACD requires in-depth management information resources to run properly. Manufacturers now provide reports to cover every possible detail most managers could desire. Typically the communications manager finds himself buried in paper with these machines. If a manager needs to know why the sales volume drops off every Tuesday at 1:30 in the afternoon, the information is right there--ten agents taking a break at the same time. If the manager needs to know why WATS costs are high and the number of calls answered are low--the reports clearly show that the number of agents is too low to handle the traffic being shuttled in.

The ACD's profit-making potential is so clearly recognizable that it provides the leverage for re-thinking the nature of communications expense allocation. The recognition of the ACD as a profit center means that money can be spent on the center in some sensible proportion to the dollars that the center generates.

The implementation of an ACD within the communications environment can do a great deal to start management thinking about telecommunications as a profit resource rather than an overhead expense.

This philosophy of communications management, that telecommunications is a profit-making tool for the efficient distribution and marketing of information, goods, and services, has guided the content of this book from beginning to end. Telecommunications is not merely an arcane field of technical specialization, although it certainly requires expertise. It is also a business function that must be managed and operated as an integral part of the marketing resources in the company.

An ACD can only perform efficiently with a precise definition of the business and communication goals it is expected to fulfill. In defining these goals it is not enough merely to study the current environment. The current environment is more likely than not sub-optimal in one or more respects. The ACD manager, or any business manager, must approach the ACD from a "hypothetical" design perspective.

It is not enough to measure the current profit margins from the switch center; the profit potential must be measured.

It is totally inadequate to measure the existing occupancy and productivity of the agent force and then manage to those standards. The development of productivity in the center must start from an analysis of the theoretical limits approached by a model center operating without the constraints of accepted practice. A ten-second speed of answer and thirty seconds of after-call work time may be the current norm--even though a zero-second speed of answer and no after-call work time may be easily achieved.

An efficient, well-tuned, and properly managed ACD will carry traffic at the optimal service level and the minimum cost.

Defining the optimal level and maintaining the ACD's operation at that level is the communication manager's task. This job requires insight into all the disparate elements of the ACD operation--from the electronic operation of the switch to the psychological motivation of the people answering the phones. This book should provide a substantial portion of the background information and general theory required to gain that insight.

The ACD may be a simple machine with 50 agents and a single switch, or it may be a three- to six-node network of ACD's with 200 to 600 agents at each

location. The level of complexity varies, but the basic operational principles can be mastered and applied to any system.

Three essential factors determine whether the ACD will operate at its higher performance level.

1. An efficient queue must be maintained, insuring the proper ratio of trunks to agents.

2. An equitable distribution of the workload must be achieved.

3. The trunks and agents should be configured to establish an optimal economic return for the ACD.

These basic factors are defined and analyzed throughout this book. An efficient queue implies that there be neither so few trunks that the agents are idle a great percentage of the time, nor that an excessive number of trunks present more traffic to the agents than they can answer within a reasonable period of time.

To attain equitable distribution of the workload, all agents must receive approximately the same number of calls. For greater answering efficiency, each group of agents should be as large as practicable.

The trunk and agent configuration should not be confused with the trunk to agent ratio. The trunk to agent ratio is concerned with the balance between trunks and agents. The configuration is concerned with the total number of trunks and agents in relation to the revenue generated or saved by each answered call. The optimal configuration is a result of a marginal productivity analysis on the trunks and agents.

In order to institute and successfully integrate these factors, the communications manager or whomever is responsible for the efficient operation of the center, must cooperate with a complex management structure. Figure I-1 outlines the levels of management responsibility which influence the ACD's operation.

Establishing an efficient ACD center is a job which requires power. Various management groups will attempt to define the ACD's operation. Whomever is to manage the ACD must have a clear conception of the ACD's required service level and general operation. Managers in the airlines industry are continually harassed by

FUNCTIONAL RESPONSBILITIES

Corporate Management

Capital Expenditure Approval

****

Administrative Management

Budget Preparation
Financial Accounting

****

Communications Management

Requirements Definition
Performance Parameters
Procurement
Network Management
Load-Balancing
Budget Preparation
Personnel Administration
Management Reporting

****

Profit Center Management and Supervisors

Configuration Control
Forecasting and Staffing
Trunking and Routing
Report Analysis
Equipment Operation
Training and Monitoring
Team Evaluation and Performance Reviews
Real-Time Supervision

****

Agents Agents Agents Agents Agents Agents Agents

Customer Interface Functions

Figure I-1

this lack of power. A typical operation may maintain divided authority over the ACD with communications management operating the switch while product management controls the budget. The communications department wages a continual tug-of-war to maintain adequate funding so that an optimal portion of the calling traffic can be handled.

Power in the corporate world is a complex derivative of budgets, influence, and information. To control the budget for the ACD is to control the machine. Total control is often not possible at some management levels, but it is a goal worth ambling toward. Information is simple to acquire and the ACD manager should understand every aspect of the machine. To speak forcefully about the proper operation of the communications center it is necessary to study the center thoroughly. Once this information is in hand, the manager's influence over the day-to-day operation of the switch can only increase.

The management groups will be competing throughout the fourteen steps listed in Figure I-2. These steps outline the required progression through the initial definition of the ACD to the final review process of an operating center. Each of these steps is discussed in detail in the following chapters, but a preliminary introduction helps explain the philosophy behind the management of an efficient ACD.

MANAGING AN EFFICIENT ACD

Requirements Definition
Long-Range Traffic Analysis
Budgetary Justification
Vendor Selection
Procurement
Site Preparation
Installation
Training
Cutover
Staffing
Operation
Forecasting
Network Definition
Performance Review

Figure I-2

The analysis must begin with a careful assessment of the ACD operating environment and functional requirements. An ACD center is a productive unit working with other revenue-producing units of a corporation. ACD's are divided into revenue centers and cost centers, depending upon whether calls generate revenue or request service information at a cost to the corporation.

An assessment of the ACD's operating environment should culminate in a document that outlines system requirements for the ACD. A comprehensive description of the manager's job should also be written. This should be an honest summary of the things you hope to accomplish and your position relative to those who may promote or hinder your goals. In many cases such an assessment will precede the selection of an updated ACD. A manager who can enter at this early juncture and assist with the initial study is then in a position to specify the operational requirements of the telephone center and the actual switch that should be purchased.

Once the parameters of the operating environment are defined, the manager should examine the performance criteria. An informal survey of managers around the country revealed that at most sites administrative managers above or beyond the communications functions were setting the performance criteria. Corporate performance criteria rarely have a rationale and rarely are based on a thorough economic and systems analysis of their effect on the operation of the ACD.

A complete effort at defining or redefining the operational requirements of the ACD, based on that initial analysis of the operating environment, is both a useful philosophical exercise for the manager and a quick way to save enormous amounts of lost revenue. The difference between management styles in the ACD center can mean the difference of several hundred thousand dollars per year in costs for equipment configurations, staffing, and trunking.

The day-to-day operations of the ACD center can be broken down into: instituting the performance factors in the system configuration, trunking requirements and staffing decisions, as well as the network configuration for multi-node ACD's; managing the physical plant and staff organization of the center--this includes hiring and firing, training, team assignment, equipment purchases, supervisory group definitions, monitoring and

quality control functions. As an adjunct to this effort, the reporting system must be considered for both internal and external forecasting and management reporting.

In short, the well-run ACD center must include the following:

1. An accurate definition of the ACD's operating environment.

2. An intelligent and closely analyzed set of performance parameters by which to judge the call-handling capability of the system, trunks, and agents.

3. A comprehensive administrative data system reporting structure and an equally comprehensive understanding of those reports.

4. An efficient management organization and a well-run staff of phone representatives.

5. A continual re-evaluation of the operating capabilities and economies of your present ACD and the ACD's of other vendors.

The final goal of the ACD manager is to achieve the stated performance parameters for the ACD center with the minimum number of agents and the minimum number of trunks at the optimal cost.

It is meaningless to say that the manager should achieve the requisite performance at the "lowest possible cost" because there are costs associated with any effort, including those resources of time and equipment used to lower costs. There must be a reasonable assessment of the cash flow derived from any cost-reduction effort. The costs of a forecasting analysis to reduce trunk usage may exceed, for example, the economies gained from dropping one or two trunks.

The rewards of efficient ACD operation are numerous. There are considerable economies that can be realized by thinking through the operation of the switch and cost-justifying the various service parameters. An efficient ACD should be able to handle short duration calls (around 45 to 60 seconds) for about thirty cents per call--including all of the machinery, agents, and trunks. There can be improvements in the satisfaction of the agent force and the telephone callers. Turnover among the agents and complaints from the customers can

be lowered substantially by such things as merit pay and efficient service levels.

Beyond this, we are in an exciting era for telecommunications. Managers who are well-versed in the present machinery can significantly affect the design and operation of the equipment they may work with in the future. There are not many communication managers who are fully cognizant of the wide variety of ACD equipment and features presently being manufactured. Those few with an understanding of this equipment and an eagerness to exploit the full potential of these machines have an unlimited future in communications.

PART II

BUYING AN ACD

DOCUMENT 2 OF 3

CHAPTER ONE

WHO NEEDS ONE?

The answer to this question is very broad. Every corporation, company, and shop which answers incoming phone calls with a staff of agents or trained people is a potential candidate for the considerable cost savings and service benefits of an ACD.

With recent advances in technology and the increased number of machines marketed each year, ACD equipment has become very cost-effective. Even the large, sophisticated ACD's which cost $ 7,000 to $ 8,000 per line four years ago are available for less than $ 3,000 per installed position. It is now reasonable to assume that operations with as few as five people can be easily served with a call sequencer, groups of 35 to 150 agents can be optimized through the use of small, limited function ACD's, and centers above this can effectively use the very large and sophisticated switching systems provided by the half dozen major manufacturers in this marketplace.

The airlines were the first companies to use modern ACD's. The enormous volume of calls that were generated by the modern reservation systems necessitated a better way to handle the calling public. Mike Huntley, at that time Communications Manager for Continental Airlines, worked with Collins Radio Company (now a part of Rockwell International) to design, build, and install the first digital, interconnect ACD. Many of the other airlines followed Continental's lead and subsequently installed ACD's from Collins. The Collins device was faster, more reliable, and less costly than the mechanical devices the airlines previously used in their reservation centers. An immediate 10 to 30% increase in call-answering efficienty was obtained at many sites replacing mechanical ACD's. A number of other vendors, including AT&T, Datapoint (the ACD division is now owned by Teknekron), Northern Telecom, Rolm (now owned by IBM), and a large number of distributors for smaller machines, entered the market for computer-controlled ACD's in the following years and the range of companies using these devices has expanded considerably.

Following initial sales to the airlines, ACD's have

been installed in banks, insurance companies, government agencies, credit card services, cable television services, newspapers, utility companies, and nearly every industry that has a service or revenue function in an incoming call center.

An ACD, particularly a stored program-controlled ACD, is more efficient than a PABX for some applications because it eliminates much of the manual call answering, simplifies the transfer process, and provides a waiting queue to smooth out the random flow of incoming traffic. This allows fewer operators to answer more calls.

In a typical PABX installation there may be only one phone line for every twenty telephones installed. An ACD environment may run with 1.1 or 1.2 phone lines for every agent position installed. The traffic demands on an ACD are much greater than those on a PABX.

An incoming call to a PABX must first determine its target phone, ring that phone, wait for the called party to lift the receiver, and technically allow the conversation to commence.

In an ACD the incoming call is recognized by the switch, an available agent is selected by the computer to handle the call, the agent is given a short tone through the headphone as an alert, and the call is connected immediately. The agents are trained to say a standard greeting. No time is wasted ringing or picking up the telephone. The call is immediately placed at an answering position. If a transfer is necessary, it can usually be handled by dialing one to four digits and then releasing the call.

There are also transfers (sometimes known as blind gate transfers) which can be initiated that require no further involvement of the agent. This type of transfer allows the agent to dial four digits assigned to the ACD itself and release a call back into another part of the system without sending the call to a specific phone number or waiting for an answer before hanging up the call. These computer-controlled answering machines can save an incredible amount of money for a communications department.

To justify the installation of an ACD the answering function must be:

1. Anonymous.
2. Homogeneous.

These two characteristics determine whether an ACD or a PABX application is appropriate for an incoming call. A PABX, or a specialized PABX such as Centrex, assigns a unique phone number to each telephone. If a customer dials the PABX number of the Burjon Corporation, for example, that customer probably wants to talk with a specific individual and is dialing the person--not the company in general.

In an ACD application the customer wants a service--not a specific individual. The customer may be calling the Burjon Corporation to purchase a replacement part or to request a serviceman for compressor maintenance. It does not matter who answers the call. The important thing is that the call be answered as quickly as possible, that the customer be allowed to within a logical fashion, and that the responsible personnel be notified by the phone representatives.

The calling traffic is considered homogeneous if anyone within a group of trained representatives can effectively handle the call. This homogeneity does not imply a requirement that only one type of call be answered at the ACD. Many operations are successful with two or three different types of calls hitting specially trained operators under heavy loads. It is necessary that the operators receive a steady flow of the various types of calls under these conditions. Without constant hourly exposure to that mix, the agent population loses the ability to answer various calls instinctively and quickly.

In a PABX or Centrex application the customer is calling because only a few individuals at that number can answer the question or provide the required service.

Many systems which are presently serviced by a PABX could be more effectively handled by an ACD. One corporation, for example, provided a dispatch function via a centrally located PABX for its nationwide network of vehicles. The system used incoming WATS lines and a bank of office telephones arranged in a pickup group to all ring on the same number. Drivers would call in and receive their assignments through the dispatch agents on the telephones. What this arrangement didn't provide was an automatic distribution of the workload among the telephone representatives. There were no reports on who was doing how much work. There was no delay queue for blocked calls. There were no trunk reports to determine the WATS usage and economy from each of the regions. In

short, there were long delays, inequitable workloads, no systematic management control, and no efficiency. An ACD was the obvious solution.

Other examples are less obvious. Another customer at a travel service had individual travel agents assigned to each account, and all of the agents handled the calls from the general public. It seemed like a good service and the customers became accustomed to dealing with one representative all of the time. Good rapport was established, and service was fairly efficient. In fact, the rapport was so good that the travel agents and their customers would chat about vacations, their families, and the weather while other customers were hearing busy signals.

The installation of an ACD in this environment proved that there was a lot more business out there beyond the pleasantries and busy signals. The customers were not displeased to be answered quickly and efficiently by a "Travel Tour Representative" instead of "Betty Eileen." The ACD reports also demonstrated that some of those calls were high-revenue calls and a great many were fishing expeditions. The establishment of separate gates (groups of answering positions assigned to specific functions) and specialized training allowed the phone representatives to understand their area better, give more efficient service, and concentrate on the high-revenue gates.

The concept of "gates" in an ACD is important because it is a feature which allows these machines to produce enormous revenues--just like the functions of queuing and equitable distribution. A gate (sometimes called a split or group) is a functional division within the ACD which allows incoming calls to be directed from a specific group of trunks to a specific group of agents.

If a caller in New York, for example, dials 1-800-515-4733 to reach a consumer complaint hotline in California, those digits will route the call across country to the central office serving that ACD. The last four digits will tell the central office to select any one trunk in a group of trunks which are terminated in an ACD gate that is staffed by operators trained to handle consumer complaints. That same ACD may have up to thirty different gates or answering groups, each with a separate phone number or with multiple phone numbers within each gate, to allow calls to be routed to people ith specialized training and information. This gives

the communications center the equivalent of "assembly line" specialization because each person can handle the task he or she understands best.

Any communications manager can improve an incoming call problem area by installing an ACD. The handling times typically drop by five to fifteen seconds per call. The number of phone representatives will drop by 5 to 10%. The trunking requirements will be reduced. The number of trunks out of service or idle will be substantially diminished because the ACD automatically checks each trunk throughout the day.

An incoming call center with 80% of its service over Foreign Exchange (FX) lines will run with 10 to 15% of its lines out of service during a given day without an ACD to assist in the monitoring. An outage rate of 2 to 5% is more typical with an ACD as a diagnostic tool. The performance of the phone representatives normally increases by a minimum of 20% over any other answering system.

The primary consideration in deciding if your department requires an ACD is the cost per call versus the cost of the equipment. The airlines produce about eighty dollars of revenue for every 1.7 calls answered. At this rate, an ACD is producing over a million dollars of revenue per month for each answering position. The cost/benefit ratio is quite high.

The retail industry is only now beginning to understand the potential cost savings which can be realized through ACD's because only now have ACD's reached a point where modern, low-cost electronic architectures will allow a reasonable payback period on a system with low-revenue traffic volumes. An expensive ACD with 120 to 150 answering positions may lease for $20,000 to $25,000 per month. The purchase price would be around $500,000. The less expensive switches (although no less in quality or functionality, so shop carefully) will run about $ 250,000 to $ 350,000 depending on the reporting options. The buyer usually wants about a twenty percent return on the money invested and a payback (profits or savings generated equal to the cost of the equipment) in less than three years. The retail industry has much lower revenues per call than an airline (about ten to twenty dollars in sales per call) and must maintain a high calling volume and low equipment costs to justify an ACD.

Who needs an ACD? Any operation which handles a constant volume of incoming call traffic can make money with an ACD. An ACD increases revenues and decreases the costs for incoming call centers. Every business with a function that fits the criteria outlined in this chapter should consider purchasing one of these machines.

JUSTIFYING AN ACD TO MANAGEMENT

Now you know you need one. Your staff knows you need one. Everyone agrees that the thing will save a pile of money, save your job and your company, but management is slow-rolling the approval. They are asking for justification.

Purchasing an ACD can require the persistence of Sisyphus. On most occasions it will necessitate rethinking the entire telephone communications operation. There will be management changes and staff changes. New jobs will be opened and old relics dusted out of their corners. The managers who successfully advocate the selection of an ACD are often putting their own jobs on the line. If the ACD fails, the manager is replaced. If the ACD is installed and successful, the manager has to work harder. Buying a piece of equipment which causes this many changes is never easy.

Management personnel cannot see the wisdom of your choice unless it is presented clearly, concisely, and in a language they can understand. That language is "money."

If the ACD provides a positive return at the bottom line, within the payback period specified by the company or at the opportunity cost rate required, the ACD will be accepted. There remains a considerable amount of juggling, particularly in a new application, to acquire the management attention and support to complete the project, but the approval of the purchase order is only the first of many steps.

The justification process has several stages. The first is a thorough study of the present communications service. Depending on the type of ACD purchased, it may be necessary to call on resources from other departments who will use the additional tandem and PABX functions that are collocated with the ACD. The overall communications budget should be presented first, followed by the portion of the budget that the ACD proposal is addressing.

An ACD installation will provide, or should provide, a number of incidental benefits that will assist in its justification to management. Although the ACD will generally handle only incoming calls on a single-node installation, most of the electronic ACD's offer some form of outcall route selection or least-cost routing package. This service can be sold to the Centrex or PABX subscribers to enhance their operations. The electronic ACD, if it is a replacement for a mechanical ACD or a new ACD replacing a PABX service function, will also bring a number of enhanced ACD features that provide economies in operation and improved service. All of these improvements, along with a chart of their costs and anticipated savings, should be noted during the presentation. These costs should be projected over the life cycle of the equipment and carried over into a cash flow statement.

The actual selection process should be explained. The management committee should be made aware of the differences between vendors and the reasons for the selection of a particular ACD. It would be disastrous not to have someone present who clearly understands the features and operation of the ACD. A consultant, or some extensive homework, is invaluable at this stage.

Top management personnel often rose to their present positions by ferreting out that one question no one knows how to answer and springing it like a steel-jawed trap around a struggling project. Usually an ACD is chosen on the basis of some trade-off between price and performance. Management will expect to know where these trade-offs were made and by what process the competition was eliminated. It may be helpful to use the present system as a starting point and explain the cost and/or feature differentials as compared to that standard. The list of features should also include such items as service, design, maintenance agreements, and expansion capabilities.

The estimated cost savings and the economies to be gained from a particular ACD and its features should be outlined at this point. Another essential topic to include in your presentation is an explanation of how the ACD fits into the overall and future communication needs of the company.

CHAPTER TWO

KEY FEATURES

There are some features which are nice to have; others which are essential. The nice features depend on the application; the essential features are fundamental to any effective ACD operation, and a switch should not be purchased without them--unless the cost differential is significant.

The features available also vary depending on the size of the installation. ACD's can be roughly categorized into three groups as small, medium and large: in a small system there are 0 to 50 agents; 50 to 150 agents constitute a medium system; and any force of agents over 150 qualifies as a large system. These divisions are primarily economic, i.e. the manufacturers of large systems are generally not cost-effective below 150 positions, while the medium-sized systems are too expensive per position below 50 positions.

The essential items fall under the two basic categories of ACD operation:

1. Call-Handling Capabilities.
2. Administrative Data System Reporting Capabilities.

For call-handling capabilities the essential features are:

Call Distribution--Uniform or Automatic
Direct Outward Dialing
System Interdialing
Transfer, Hold, Conference
Queuing and Intraflow
Automatic Console Answering
Emergency Alert
Incoming Call Identification
Night Service
Delay Announcements
Calls Waiting Indications
Supervisor Assistance and Monitor
Routing Facilities
Outbound Telemarketing
DNIS Interface

The distinction between uniform and automatic call distribution is important because the distribution scheme for calls within the ACD determines whether or not there will be an equitable distribution of the workload among the phone representatives.

Uniform distribution means that the ACD maintains a list of all the answering terminations in the system and distributes the traffic according to that list. When a call enters the switch, the computer will look down the list of available agents and give the call to the first phone on the list. The second call goes to the second phone and so forth. It may be that one phone further down the list has been idle longer than a phone at the head of the list, but the first phone will still receive the next call. The agents will be forced to work an unequal amount of time based on their position in this list.

Automatic call distribution eliminates this problem. Automatic distribution does not hunt down a list, it tracks the actual workload and diverts calls to the agents who have been idle the longest. This system is still not completely foolproof. Agents can beat this feature by setting themselves "unavailable" after each call rather than remaining in the available and idle state as they should. When agents reset their position to the available state they will have gained some additional time out of the call-answering process. Managers must carefully analyze the performance reports provided by the ACD to insure that agents are not artificially invoking features that provide excess time off.

Direct outward dialing allows callers to interface directly with the outside world through the regular telephone dialing plan. Callers in the ACD center can access the public telephone network without routing through an operator or a PABX.

System interdialing allows anyone within the ACD to dial any other position in the same ACD by keying a four-digit extension number.

Transfer, conference, and hold capabilities are essential for the smooth functioning of the supervisor assistance to agents and to pass customers to other answering positions in the ACD.

Queuing is the principal reason an ACD saves money. Because the flow of incoming traffic is random, a queue,

or waiting line, reduces the number of agents needed to handle a given average load of traffic. The queue averages out the random flow of traffic and decreases the peak traffic load by holding the callers until the traffic load lightens. The queue also insures the maximum work efficiency in the agent group by allowing the center to add slightly more lines than would be normally required in order to compensate for any delays in the telephone company's central office or toll office equipment.

In many switching centers there can be a four- to seven-second delay after a call is disconnected before the next call is sent down the line. This disconnect time is simply wasted money, unless additional lines are added to insure a steady flow of calls to the agents.

Intraflow is another aspect of queuing. Each gate in the ACD should have a queue and intraflow capability. This allows agents in multiple gates to handle calls for each other and increases the size of the waiting line. As traffic engineering indicates, these larger queues allow a greater intensity of calling traffic to be handled with fewer agents. The consoles should be capable of automatically and immediately sending or giving the calls to an agent without manual intervention. If agents are not required to manually answer calls, the handling times are significantly lowered. As a part of this function the agents should also be allowed to manually release or disconnect a call.

A system which automatically accepts and disconnects calls is too slow. The automatic disconnect can take as much as six seconds for each call and this additional time is billed against the ACD. The explanation for this slow disconnect time is found in AT&T's "Notes on the Network." In the event of a called party disconnect (one where the ACD agent hangs up first), the specification calls for the immediate connection of another call on the line after a 40 to 75 ms delay for the tone plant to be placed back in the circuit. In the event that the calling party disconnects first (that is, that the person dialing in hangs up before the agent disconnects) then the specifications call for a delay of greater than 6 seconds before placing another call on that line. This is a terrible waste of capacity and helps explain why a high abandonment rate at a center artificially increases the apparent traffic congestion at the center. Agents must send the release signal to the central office

before the calling party is able to hang up the phone. Each "Thank You, Goodbye." should be punctuated by a quick stab at the console release button.

The call-handling features include those capabilities which allow the system supervisor to enter configuration control commands at the ACD. These commands allow dynamic reconfiguration of the ACD to meet changing traffic loads. The system supervisor should be able to add, move, alter, and drop agents, as well as PABX consoles and trunks, in the system. The supervisor should also have access to the routing commands and the class of service assignments.

Emergency alert is critical for any large business that is subject to occasional harassment by bomb threats or obscene phone calls. The emergency alert function will allow the phone representatives to connect a recording device into their conversation and obtain a record of the trunk on which the call was placed.

Incoming call identification alerts the answering agents as to the type of call they are handling. Typically a short message will be assigned to each incoming group of trunks and the operator will hear that message (for instance: "Miami") just before the call is connected to the telephone.

Rather than announcing the message through the headphones, there are ACD's available which display this information on an LED readout at the agent's console. This is a superior method for most situations because it avoids the one-second delay introduced by the announcement before a call is connected. There is also a much more positive recognition of the actual trunk group used if the agent can refer to the display throughout the conversation. With the appropriate software and the installation of DID InWATS, this display can also be used to show the actual phone number dialed by the calling party. This allows the call to be handled with any special information or greetings which are relevant to customers from a specific area.

Night service provides a recorded message to callers who attempt to reach the ACD after regular business hours. Instead of simply turning off the machinery and letting callers hear ringing, the ACD will connect the call to a message which relays the business hours or another number for emergency service.

Another function of night service is to transfer

all the incoming calls into one set of answering positions. This allows the ACD to keep just a few positions open and still answer calls from all the different gates. Night service can be used in either fashion, a recording or a transfer function, but it is essential to provide professional service.

Delay announcements are important money-saving features which help keep the queue working in an efficient manner. Since telephone traffic is random, there will be occasional bursts of traffic in any well-configured ACD. These increases in traffic volume force callers to wait for service longer than they would like. The delay announcer breaks into the line and cheerily informs the caller, "Our operators are temporarily busy. Please remain on the line and a representative will assist you shortly." Without this announcement most people will hang up after five or six rings.

The delay announcer also allows some savings on WATS charges. If the delay announcer is set to break in after six rings, there will be no charges on the WATS line during the ring cycle until the announcer cuts in. The delay announcer knows if there are agents available to answer calls and will hold callers in the ring cycle (up to a selectable maximum time) until an agent is available or until the selectable delay time is reached.

The calls waiting indication prods the phone operators to complete their present call more quickly and answer the backlogged calls. The calls waiting indication is usually a lamp on the console which will light whenever there are calls waiting to be answered. Many ACD's offer selectable settings on the lamps so that the indicators will flash at different rates depending on the number of calls backed up in the queue.

Supervisor assistance and monitoring capabilities are needed to provide expert advice to operators on difficult calls and when permissible, silently listen to agent-customer conversations to insure polite and efficient service. The assistance function should allow operators to request help without interrupting the call in progress (that is, they should not have to place the caller on hold to alert their supervisor); it should allow a supervisor to monitor the call before interrupting. The operator should also be able to place a call on hold when desired and confer with the supervisor privately.

The monitor capability is controversial. Some

unions and state laws will not allow a silent monitor. This feature is essential if good service is to be maintained. Without monitoring capabilities, the telephone offers such complete anonymity that an agent may yield to unprofessional temptations. We know that the customer is not always right, but there's no sense letting the customer know.

The outbound telemarketing function in an ACD is a relatively new application that was first developed by Rockwell International for the Internal Revenue Service and is under development by at least two other ACD manufacturers.

The telemarketing feature combines a software process that manages telephone number lists with an autodialer attached to the ACD. The early versions of this feature merely presented a list of telephone numbers at the agents CRT screen, then automatically dialed the numbers selected by the agent. The more sophisticated packages currently under development will operate independently of the agent. The machine will dial a list of numbers, and voice detection equipment will determine whether the call reached a busy signal, a ring no answer condition, or a person saying "Hello." Before the person is more than a few milliseconds into the "Hello" the ACD will transfer the call back to a waiting operator along with a canned script at the CRT that lists the contact's name and the product sales script.

The most conservative estimates for a telemarketing package indicate that this intelligent dialing function should save 30% of the agent labor expenses by reducing the non-productive time that agents spend dialing bad numbers.

The DNIS (or Dialed Number Identification Service) interface is also relatively new and was originally developed by Northern Telecom. This feature uses the DID InWATS service from AT&T and allows the number dialed by the remote caller to be displayed at the agent's console before the call is answered. The DNIS feature allows a telemarketing organization to advertise multiple telephone numbers in a city. The response generated by each advertising channel is measured by counting the calls taken on each different 800 number within that city.

REPORTING PACKAGES

The essential reporting features are outlined below. The reporting package is one of the most important reasons for buying a modern ACD. Without detailed, comprehensive, and accurate reports, the ACD will never operate at peak efficiency. The reporting package in an ACD takes the guesswork out of managing the machine. There will be a detailed breakdown of the amount of traffic, the efficiency or deficiency in the agents' answering abilities, and a complete set of trouble reports. From there it is a matter of understanding, interpreting, and applying the results of the reports to improve the operation of the switch.

System Reports
Agent Information Group Reports
Delayed Call Records
Trunk Reports
Trouble Reports
Overflow/Diversion Reports
Network Reports
Billing Records
Call Records
Agent Performance Reports

There are several major divisions within the reporting structure which should be available to effectively utilize the information gathered by the ACD.

System reports are the most general category and contain the statistics at the gate, or split, level. These statistics highlight the interface between trunks from the outside world and the answering efficiency of the operator or agent groups. These system reports usually appear as real-time displays on a CRT screen at the supervisor's desk and also as printed reports. These printed reports are shown every half hour throughout the day and again at the end of the day in summary figures. The system reports will show the amount of incoming call traffic, the number of agents available to handle that traffic, and some summary fields about the efficiency of that answering procedure: average speed of answer, service level, length of delay in queue, and miscellaneous fields about outcalls and outcall talking time. The system reports are the essential summary of the quality of service that the outside world is receiving from the ACD center.

The next major division in an ACD's reporting package summarizes the call-handling activity of agent

information groups. The agent information group reports are valuable for comparing different groups of agents within one gate or split. The information group reports allow any number of agents within a gate to be isolated in a smaller subset of the gate. For instance, this allows the system manager to place all college graduates within one group and all high school graduates within another group. These two groups can be compared to determine the relative advantages of hiring based on education levels.

The information groups are also helpful because they can be used to assign a group of agents to each supervisor or team leader. The performance of individuals under a specific manager can then be determined. This allows the supervisors to implement additional training or staffing based on each group's performance in relation to other groups. The basic distinction between the information groups and the system reports is this ability to bracket groups of people within subsets of the answering gate and compare their performance.

The delayed call profile reports are used to determine the length of the delay queue and the length of time that people are willing to wait before they abandon their call. These reports are displayed in several different forms depending on the ACD purchased, but all of them show the number or percentage of callers who waited a given period of time before their call was answered or before they abandoned the call. The delayed call spectrum times delays over five-second intervals, from zero seconds to several minutes. This information is invaluable for determining how many agents to place on the phones. If customers are willing to hang on the phone a very long time, the service level can be degraded to match this tolerance.

The trunk reports are the primary traffic engineering tool for the ACD. A few ACD's offer a built-in trunk forecasting package. All the modern ACD's provide some reports of this type which assist in determining the blockage (how many calls are being held) and level of service on the incoming trunks.

Agents and trunks are the major expenses in an ACD center. The trunk reports are necessary to insure that these valuable facilities are operating in an efficient manner. For any number of reasons trunks are prone to failure. FX circuits in particular are likely to be out of service as much as 10% of the time during a given

month. The implementation of an ACD with advanced trunk reports will usually reveal that twenty to thirty percent of the trunks connected to the old machine were faulty. Twenty to thirty percent of the lines were connected, paid for, and generating no revenue in return.

Any factory which did a head count and suddenly discovered thirty percent of its workers were dead--merely propped up in their chairs--would be justified in expecting a productivity increase along with some new management. The trunk reports on the modern ACD's provide a sophisticated form of electronic management in this area. No longer is it necessary to rely on the simple peg counts that are typical of older, mechanical ACD's. Peg counts are now just one of many trunk reports found in the newer ACD's. The reports will also show the number of calls offered, handled, and abandoned, along with the trunk holding time and the percentage of time that all trunks in a group were filled with traffic. With these reports traffic engineering becomes less a matter of complicated formulas and tables and more a matter of intelligently interpreting the hard data.

Trouble reports are simply maintenance aids which allow the ACD to communicate its problems. If there are errors in the software, or the hardware malfunctions, then these trouble reports are sent to a monitor screen or a printer to alert the operators and maintenance staff.

Overflow/diversion reports are only required if this feature is provided on the ACD. The more sophisticated ACD networks with multiple-node ACD's around the country use this feature to share the call-load among all the ACD's in the network. The reports show clearly how much traffic each ACD is feeding to another. The problem with diverting calls is that managers typically do not want to do work for which they are not rewarded. Unless the reports show clearly how much traffic each manager is shipping to the others, they will play a negative-sum game where each manager degrades the service level to force a distant switch to handle his traffic. The manager who can do this successfully appears to be a winner. Of course the customers suffer because the service levels are degraded at all of the sites, while their calls chase each other around the network in search of a center with the kindness--or the service level--to take them in.

Network reports are similar to overflow/diversion reports. This feature is not implemented in every ACD. When the ACD is used as a private long distance toll network, the reports should clearly show how much traffic is being routed around the network.

Billing records and call records are also important in a communications management environment seeking to control costs. Many ACD's are capable of collecting the same type of SMDR information (Station Message Detail Recording) about time and duration of individual calls that PABX's currently gather. These individual records are useful for billing long distance charges and system usage back to individual departments. Often simply making people aware of their calling patterns tends to decrease the usage of toll facilities.

The agent performance reports are a special category available on many ACD's. Agent performance allows the system manager to assign an individual agent identification number for every agent in the system and the computer will then track the performance of individual agents throughout the day--no matter which console or telephone they use. The agent performance identification number gives the supervisor total freedom to move agents about the center without worrying about altering the validity of the group or system reports.

This section only provides a brief outline of the features which should appear in an ACD. The ACD, like the PABX, has become so complicated that only a detailed analysis of each particular site's communication function will indicate which of the possible features are needed.

CHAPTER THREE

TECHNICAL CONSIDERATIONS

There are some basic technical questions which must be asked and answered during the ACD selection process. Buying an ACD is, in some respects, much like buying a modern stereo. There are any number of distinct operating philosophies and general differences; there are an even greater number of indistinct technical differences.

In the final analysis, the day-to-day reliable operation of the ACD is more important than any rarified engineering arguments about relays, PCM, PAM, TDM, and SDM.

This day-to-day operation is guaranteed more by the manufacturer's reputation and the documented history of the installed base than by a four-inch proposal with envelope delay distortions and harmonic imbalances spelled out to the umpteenth decimal point.

A contract with specific penalties for non-performance is the only accurate gauge of the vendor's private confidence level. As specified in the chapter on contracts, the vendor should be willing to pay specific sums of money for the failure of any aspect of the equipment. AT&T provides rebates to customers when a line is inoperative beyond a specified number of minutes. The ACD manufacturer should be willing to pay for downtime on the equipment and provide rebates for slow repair service. It will usually be a battle to get these guarantees, but the fight will be worth the rewards.

Nevertheless, there are differences in the design and operation of the various ACD's on the market--differences which may be insignificant today, but perhaps devastating tomorrow when the switch is expanded or made part of a more sophisticated network.

The technology of the future, the technology which will allow the greatest potential for economic growth and sophisticated performance, is the stored program-controlled, fully digital, time-space-time switching matrix, T-1 compatible, electronic ACD. Such an ACD is

not the only available alternative. The analog switches will transmit data up to 9600 baud as readily as the digital switches, although the analog switches are not able to reach the kilobit per second rates possible with digital signals. The mechanical ACD's still answer calls and perform a basic set of functions. However, the fully digital ACD's are the best answer to the widest range of communication problems, particularly in the large system sizes.

The cost of these devices is dropping dramatically. A price war of sorts is just beginning in the ACD marketplace. For the last several years PABX manufacturers have been attempting to garner market share by competing on price. The ACD is finally reaching a size where similar attempts to gain market share will start. AT&T and Rockwell International held price umbrellas over this marketplace in the past, but they are going to be forced to compete aggressively on price as IBM-Rolm and Northern Telecom try to capture the market share.

The smaller ACD's typically employ a micro-reed relay switching matrix because this is a less expensive solution for the smaller line sizes. These switches also consume slightly less power than the digital switches, although the increasing use of CMOS components and high density cards in the digital switches is erasing this advantage. The relay matrix becomes impractical at larger line sizes, and the economies possible in small switches diminish as they approach the line sizes of the digital models.

A digital signal is a series of discrete pulses with the electrical current alternating rapidly between high and low states. An analog signal does not display distinct steps, or levels, and amplitude of the analog current varies smoothly like a wave or maintains the steady voltage of DC (direct current). Either analog or digital signalling can be used to accomplish most tasks in telephony, but the digital method has distinct advantages.

Digital signals provide greater resolution and accuracy than analog signals. Each portion of a telephone conversation carried on a digital circuit is sent down the line as a mathematical representation of the spoken sounds. The discrete on and off pulses in the digital signal represent numbers, which represent the analog sound of the actual speech. Once those numbers are copied into the carrier signal there is much

less chance for distortion.

With the digital signal the problem of circuit distances is almost eliminated. The digital signal can be regenerated at several points in the transmission circuit and the signal will be reproduced exactly at each point. An analog switching system amplifies the line noise whenever the signal is amplified and induces distortion.

The multiplexing capability of digital signals, weaving several channels together on a single voice line, allows the transmission of twenty-four voice channels on each telephone line. The digital signal can use its mathematical encoding to represent almost any dynamic range, as opposed to the limited reproductive ability of common analog circuits. The digital signal also resists transmission corruption because the discrete pulses are not as vulnerable to the component specification changes which accompany operation in a hostile environment. Exposure to heat, moisture, and electrical fields will adversely affect the operation of an analog circuit more than a digital signal.

The design of digital equipment allows for greater control and intelligence in the operation of the switching device. The operation of the switch, as it is manipulated by the computer controller, can be monitored. The service lines for a digital switch can be used for a wide range of purposes. The same digital channel can carry data and visual signals, as well as voice signals.

In order for a voice communication to travel over a circuit, into a digital switch, and back over another line to the called party, there must be several conversions from analog voice signals to digital signals. On an all-digital network, with each switch in the network operating on digital transmission and switching principles, there would be a considerable reduction in the network's cost.

The current telephone network requires that a digital ACD convert the switched digital voice channels back to analog signals before they can be transmitted over most portions of the telephone network. Every time this conversion is made, the associated equipment to perform this function must be installed. With an all-digital network, the analog to voice conversion would only be done at the individual's telephone. This would eliminate a great deal of costly equipment and improve the overall transmission quality of the network.

Not everyone, however, agrees on the transmission standard which will be implemented in the all-digital network. The European standard for digital transmission is different from the American. Most equipment vendors now have the T-1 standard available for their switches and are compatible with direct links to a digital central office.

With the introduction of AT&T's high capacity digital services at T-1 rates, the use of direct digital connections to the central office and the toll switching office will become a standard practice. The T-Carrier services offered by AT&T Communications are dramatically less expensive than equivalent analog channels and should be used as FX replacements wherever there is sufficient traffic volume.

Digital switching is the technology of the future and will be the basis, in one form or another, for all of the digital public telephone network. The cost economies and expanded capabilities introduced by a digital switching matrix with computer control will make digital switches the standard equipment of the not-so-distant future.

Undoubtedly, the mechanical switches and the non-digital, stored program control switches will be able to interface with this digital network, but they will require additional expensive equipment to accomplish this function. Also, their features may not be fully compatible with the rest of the digital network.

In order to evaluate the technology in the switch used by a given vendor, it is necessary to acquire a fairly extensive education from the vendor, the engineering documents, and system practices. Sometimes this evaluation will not be necessary because of the vendor's reputation or the contractual relationship with the vendor. However, if a new entry to the marketplace is being evaluated, or the switch is for a very expensive or sensitive project, then it is mandatory to understand the architecture, software, electronics, service, and operation of the switch before any purchase is made.

The following discussion will just touch briefly on some of the key points that should be examined. The actual analysis should be performed by the user to insure that a full understanding of the switch is obtained.

The basic components of an ACD include:

1. the distribution frame which interconnects the switch with the telephone lines;

2. the peripheral equipment section which controls the operation of the lines, telephones, and any auxilliary equipment;

3. the common equipment section which controls the actual switching of calls through the digital matrix;

4. the power equipment section which provides power to the switch and the attached devices; and

5. the software which actually drives the functions in the switch.

Most of these sections consist of cabinets or frames with a modular construction of backplanes and shelves that allow equipment to be plugged into the cabinets as the switch grows. It is important to check the switch for its growth capabilities. Many older style architectures required that entire cabinets or processors be replaced as the switch expanded even modest amounts. Most of the modern ACD's will allow growth in the range of a 1,000 lines just by adding shelves and cabinets without any significant changes in the processor architecture of the switch configuration.

The shelves in the cabinets are typically filled with printed circuits cards that determine which functions are supplied and which features are supported.

These printed circuits cards should be interchangeable wherever possible and of rugged construction for easy replacement. The best option is to allow the insertion or removal of cards without powering down the switch itself, or with only the affected shelf powered down. The trunk cards and station cards should be interchangeable on a given shelf or within a cabinet. This should eliminate the need for buying another cabinet when a switch, for example, requires an unusual amount of trunking and station card slots are empty.

The common equipment section of a switch typically provides the processor, memory, switching systems, conference circuits, digit transmitters, tone supplies, software magnetic tape unit, and control CRT or TTY

interfaces. These functions serve all the activities and callers on the switch and are central to the operation of the switch.

The common equipment section communicates with the peripheral equipment over an internal communications link known as a system bus or loop. The system bus or loop is one of the key limiting factors in any switch architecture because this electrical interface determines the amount of information that can flow between the peripheral trunk or station cards and the central processor.

The implementation of this system bus is one of the principal differences between early PABX's and ACD's and the current or "next" generation voice/data ACD's. The effective bandwidth of this bus (which determines the amount of information that can be transferred within a given time period) controls the number of trunks and stations that can be served on a given switch, as well as the speed with which data can be transferred through the switch.

The early Rockwell Galaxy switch provided a non-blocking architecture which guaranteed 32 CCS of traffic-carrying capacity to each trunk connection. This meant that there was never any possibility of failing to answer a ringing trunk. It also meant that switches which were not generating 32 CCS of activity per trunk were engineered for capacity which was not used.

The PABX manufacturers, such as IBM-Rolm and Northern Telecom, who have entered the ACD field take a different approach. They engineer greater capacity as it is needed by adding cards (network loops in Northern's terminology) which increase the effective traffic-carrying capacity of the switch. This feature allows those vendors to supply only as much capacity as is needed, yet still appear to be non-blocking at any given traffic level for which the switch is engineered.

The fact that these switches have to be "engineered" means that when evaluating a new entry to the marketplace the communications manager or analyst should have a detailed understanding of that engineering process. This understanding will insure that an adequate amount of traffic-carrying capacity is available for the number of stations and trunks that will be attached to the switch. An SL-1 switch from Northern Telecom consists of network loops or multiplex

loops which operate at 2.048 Mb/s and support 160 PABX stations per loop. In an ACD environment the number of agent consoles per loop is substantially less.

These network loops allow the common equipment to communicate with the peripheral equipment. Any incoming calls are answered in analog form by the trunk cards, digitized by the peripheral equipment,and sent to the common equipment for processing. The common equipment receives the digitized signalling information and voice streams and routes that call back to the proper agent console or outgoing trunk.

In the larger ACD systems most of the equipment in the common equipment cabinet will either be redundant or capable of redundancy as ordered by the customer.

For the evaluation of a new switch it is important to understand the configuration of the common equipment, how the processor and the peripheral equipment interact, and the manner in which failures and software changes are accounted for in the switch.

The main memory on the CPU should be redundant and error correcting with appropriate alarms in the event of any failures. The CPU and main memory reload procedure should be fast and effective as an electrical outage will erase any routing information from the CPU.

The peripheral equipment should include all of the common trunk types that will be used in the center.

CHAPTER FOUR

USING AND ABUSING CONSULTANTS

Consultants can be an invaluable aid if they are competent and honest. These characteristics, however, do not miraculously materialize just because a marketing walkout or disgruntled engineer hangs out a consultant's shingle. Consultants are most comfortable with what they know best. Consequently, a lot of consultants will recommend the same vendor's equipment time and time again, no matter how absurd the application and the fit.

Consultants, like the rest of humanity, dislike it when their cars run out of gas or their condo payments fall behind. Everyone has participated in head-to-head sales competitions where the consultant was either completely ignorant or paid off by one of the vendors. Some consultants will work on the basis of a percentage kickback from the vendor or they will recommend certain vendors with the understanding that their organization will receive the training, system design, or installation contract.

There is no foolproof way to determine that a consultant is honest, although one should make the effort. If the communications staff is totally unequipped to make the design and purchase decision themselves, they should consider hiring a permanent staff member to educate them. If the job is small enough to warrant a consultant, or specialized enough (like a network installation), some detective work should be done before choosing the consultant.

Check the consultant's credentials. Obtain a list of clients and interview those people to determine what the consultant did and didn't do for them. This procedure is the same that should be followed in checking out a vendor. Neither consultants nor vendors should be indiscriminately believed--only contracts and working examples have the solid feel of credibility.

The consultant's work record should include awards to a variety of companies unless some vendor is offering a clearly superior product--in which case you could have chosen it yourself. Again, if a consultant is choosing only one vendor, the ties may be too close for objective consulting.

Never choose a consultant recommended by a salesman. If the salesman recommends two or three companies and suggests you give them a call that is one thing; but if the salesman says, "Contact John over at 314-4526," then start looking in the Yellow Pages. The consultant should provide a written contract that there is no conflict of interest and that there is no compensation from any vendor.

The consultant should serve as an aid. He should not take the place of an informed decision by the communications manager. The final proposal, the vendor interviews, the site examinations, and the price quotations should be the result of a joint effort with the consultant. The consultant should not monopolize the information sources and then hand down a final decision.

This same warning applies to studies done by AT&T or any other company for your application. Both groups will offer free system analysis services as part of the sales pitch. These are an invaluable source of information, but they should always be carefully reviewed and fully understood. In many cases the free services offered by vendors may eliminate the need for a consultant.

The consultant should spell out, in detail, the fees which will be charged and the services which will be performed. A contingency fee based on the savings produced should not be accepted. Any job can be done quicker and with cheaper materials. The consultant should work for a flat fee and at a rate that is justified by services rendered.

Choosing an ACD is not that difficult. Most of the major ACD vendors on the market today provide competent, manageable ACD service. Some are better or worse; some are more costly or less expensive. The critical factor is selecting an ACD which fits the corporation's projected growth patterns and special needs.

The really challenging task is making the ACD, whichever one is selected, work at the optimal level. In the ACD arena, a consultant who can say how to install, maintain, and manage the ACD is more valuable than one who can tell you which vendor to select. The ACD consultant should be able to provide a complete range of analysis functions and management suggestions

CHAPTER FIVE

WRITING THE PROPOSAL

Countless one-million to ten-million dollar ACD's have been purchased by one member of the communications staff listening to the sales pitch of each vendor, studying the literature, and picking the winner.

In other cases a cast of hundreds has spent thousands, writing proposals, investigating sites, traveling to meetings, traveling to meetings about the previous meeting, and generally looking into every detail short of sitting down in each factory and soldering the ACD together themselves. Unless the system is very large and very special, a formal proposal and such intensive involvement may be unnecessary. A communications manager would have to know a great deal, that is, at least should have worked for a vendor at some time, in order to ask all the right questions.

The one thing the purchasing team should know is exactly what functions they want the ACD to perform. This should not take the form of a closed description. Such descriptions, often included in a Request for Proposal, may lock the buyer out of a better solution. The ACD may provide an answer to a communications problem that doesn't even resemble the question. The greatest weakness in a formal proposal is that each vendor may respond with everything the department wants, but never reveal the other things they didn't know enough to want. The best approach is to completely understand the present communications system and then bring in the salesmen to explain where the ACD fits.

AT&T marketing teams have been particularly good at this. They will hold a two-day session at the customer's site, learn their operation, and then explain where the ACD fits into that operation. Of course, the other vendors should be allowed the same opportunity because they might fit just as well--for twenty percent less. A proposal can save money and investigative time by eliminating the clearly inferior or ill-suited vendors, but a quick examination of their literature may accomplish the same results. The terminology differences among ACD's are so great that responses to proposals may only provide the vaguest idea of who can do what.

A sound approach is to invite each vendor in to explain the capabilities of his or her ACD, visit a working (in a business environment) site, and make a lot of telephone calls to check out each company's reputation and quality. Now, if you still want to write and submit a Request for Proposal, there are some things to include.

Do not allow any manufacturer to bid a paper tiger. If the vendor is known and trusted, it is fine to engage in some joint development efforts. However, it is not an uncommon ploy for manufacturers to push other vendors out of the running by bidding features not currently installed and offering a "budgetary" price on those features. A budgetary price should never be accepted in a contract. Accept only fixed prices. There should be penalties attached for failure to deliver and failure to meet the specifications.

SAMPLE PROPOSAL OUTLINE

1. INTRODUCTION

2. VENDOR INSTRUCTIONS
   - 2.1 General Instructions
   - 2.2 Proposal Organization

3. FUNCTIONAL SPECIFICATION
   - 3.1 System Configuration
     - 3.1.1 Hardware Description
       - 3.1.1.1 Floor Plans and Environment
       - 3.1.1.2 Matrix Description
     - 3.1.2 Software Description
     - 3.1.3 Signalling Interfaces
     - 3.1.4 Generic Release Schedule
     - 3.1.5 Configuration Control Capabilities
   - 3.2 Call-Handling Capabilities
     - 3.2.1 Call-Per-Second Capacity
     - 3.2.2 Uniform or Automatic Distribution
     - 3.2.3 Standard Features
     - 3.2.4 Optional Features
     - 3.2.5 System Limitations (Nodes, Lines, etc.)
     - 3.2.6 Trunk/Line/Agent/PBX Mixes
   - 3.3 Reporting Capabilities
     - 3.3.1 Real-Time Reports
     - 3.3.2 Printed Reports
     - 3.3.3 Complete Report Descriptions

3.4 Network Capabilities
- 3.4.1 T-1 Compatibility
- 3.4.2 Network Interfaces
- 3.4.3 Numbering Plan
- 3.4.4 Routing Structure
- 3.4.5 Maximum Nodes
- 3.4.6 Network Control Center
- 3.4.7 Loss Plan and Network Analysis Services

3.5 Expansion Capability

4. TRAINING SERVICES
- 4.1 Supervisor Courses
- 4.2 Agent Courses
- 4.3 Maintenance Courses
- 4.4 General Courses

5. MAINTENANCE AGREEMENT
- 5.1 Maintenance Response Time
- 5.2 Optional Maintenance Contracts
- 5.3 Remote Diagnostic Capabilities
- 5.4 Service Depot Locations
- 5.5 Spare Parts List
- 5.6 Preventive Maintenance Calendar
- 5.7 Maintenance Charges
- 5.8 Self-Maintenance Support
- 5.9 Estimated Life Cycle Maintenance Charges
- 5.10 Documentation and Update Service
- 5.11 Warranty
  - 5.11.1 Hardware
  - 5.11.2 Software
- 5.12 Ongoing Software Support
- 5.13 Vendor or Distributor Maintenance

6 PRICING
- 6.1 Itemized Feature and Option Prices
- 6.2 Installation Prices
- 6.3 Estimated Operating Expenses
- 6.4 Lease, Rent, and Purchase Cash Flow Analysis
- 6.5 Sample Moves, Changes, and Addition Charges

7. INSTALLATION AND CUTOVER
- 7.1 Installation Schedule
- 7.2 Acceptance Test and Diagnostics
- 7.3 Cutover Plan
- 7.4 Cutover Support (Hardware & Software)

8. REQUIRED FEATURES
- 8.1 Essential Capabilities
- 8.2 Present System Configuration and Operation

This outline should keep the vendor's marketing department tearing their hair for a few days and supply the purchaser with some useful information. The general philosophy of this outline is to allow each vendor to state what is available, not to demand x, y, and z snappy features from the vendor. There is more to be learned by a general "how does it work" question and answer proposal.

The information accumulated should be arranged in a matrix to compare each vendor, with points assigned to each feature as weighed against the price. The essential thing to keep in mind is that price is not really the object: performance is of principal importance. Almost any PABX will offer so many bells and whistles that no one can take advantage of them. In an ACD all those special features will be used every day and can make the difference between an effective traffic flow and a bottleneck.

The prices should include everything needed to move the ACD from the manufacturer's factory up to the turnkey installation. Nothing should be extra or additional unless it is clearly spelled out. Once all of this has been accomplished and a vendor is selected, some additional items should be added to the outline. A more complete cutover and installation plan are necessary, along with some guarantees, but the contract will provide for that.

Once the proposal response is received from the vendor, it is important to evaluate that response in the proper context. The principal source of information is the sales representative serving your account and a word of warning is required in handling this relationship.

Most sales-oriented people are bright, well-informed, highly motivated, willing to take risks, and hungry. Hungry is the key word. Nothing they say should be believed. Nothing anyone says should be believed if it isn't written down in a contract with specific penalties attached. The features of an electronic ACD are so advanced that no one can understand all of them. Usually it will take a group of people from the software department several days to competently answer a list of questions from a RFP (Request for Proposal). A sales presentation should be taken as a general indication of the ACD's capabilities. Complex questions should be written down and receive a written response.

Despite these warnings, no one can be more helpful than the sales or marketing representatives. A potential customer has a great deal of visibility within any organization. When a sale is hanging in the balance, a great many people tend to listen. Demand everything and hold out until the final moment--when the lawyer's pen slides across the contract. There is much to be gained and little to be lost by taking a hard line.

CHAPTER SIX

CONTRACTUAL REQUIREMENTS

Most of the contractual decisions will not be left in the hands of the ACD manager. Even a relatively small buyer will or should retain the services of a lawyer. Regardless, it makes sense to be knowledgeable in this area to insure that the communications department is buying all that it wants and needs. When buying any product it is necessary to be thoroughly covered for the potential disasters of business failures and dissolved distributor arrangements.

The written contract actually means little or nothing if it is not thoroughly researched. There is no smaller glory than winning a contract dispute in court while your business is crumbling around a poorly considered piece of equipment. The contract should not take the place of a thorough investigation of the vendor and the vendor's product prior to any purchase agreement. Any contract will have to be tested in the courts if the parties disagree on the fine points. Anything in the contract which is illegal will not be upheld in the courts simply because your signature appears on the bottom line.

There will be different contractual concerns depending on whether the contract covers a cash purchase or a lease. Each contract will have to be modified to account for these differences. In general, if all the information included in the proposal outline is included in the contract, the main points of contention will be covered.

The contract should contain a detailed description of all the purchased features and options. This description should explain, at the functional level, how each feature works and what capabilities the buyer should expect from the ACD. It is a good idea to attach all of the correspondence and material relating to the proposal to the contract. The proposal itself should be attached to the contract as an addendum to insure that any items promised in the proposal response are really available on the equipment contract. Each item should be clearly labeled with the date and title. Any conflict between the various product descriptions should be resolved at the discretion of the buyer.

A section of the contract should be devoted to project management. The basic purpose of this section of the contract is to insure continuity in personnel during the design, installation, and cutover. This section should also specify the development and communication of milestone charts and progress reports during the life of the project.

Site preparation should be defined in the contract in order to clearly delineate what facility improvements should be performed by the customer versus those assigned to the equipment vendor. Many ACD's require special rooms, extra air conditioning and dehumidifying equipment or separate vented rooms for the batteries. All of these items should be specified in detail to avoid confusion or oversights during the project.

The same level of detail specified in the site preparation section should be applied to the installation schedule and description. All of the major activities in the installation process should be listed along with designation of the responsible party. It is important in this section to specify that the vendor supply all the labor and all cables, wire, and hardware involved with the installation of the equipment. The installation cycle is often an area where unscrupulous vendors will attempt to increase the actual price of the switch by charging extra for items that were supposedly included in the "turnkey" bid.

The reliability of the equipment should also be entered as an attachment to the contract. This will clearly document the expected performance standards of the ACD equipment.

The financial portion of the contract should provide a full and detailed accounting of the prices related to these areas:

Purchase Price
Shipping Charges
Insurance
Delivery Schedules
Tax Credit Rights
Property Tax Claims
Title Assignments

The contract should also include the conditions under which the buyer can withhold payment for noncompliance. Usually the buyer is in a strong position with regard to holding back payments. Few

vendors are willing to take a buyer into court and place their failures on public record.

The financial section should contain a price catalog for all items sold with the ACD. Though it is often difficult to fix the cost of these items, an escalator for inflation may help. For the most part, the technology is changing so fast that the price in ten years will bear little resemblance to the original purchase price and the part itself will probably have been altered significantly.

INSTALLATION AND ACCEPTANCE

The installation description in the contract should include a complete schedule and milestone chart for work to be performed. This description should also include explicit directions about which parties will do each portion of the necessary work. The installation itself should conform to all the applicable FCC regulations and local building codes. The initial site survey performed by the vendor should detail any changes required in the buyer's installation and equipment room to accommodate the ACD. It is sometimes not discovered, until after the ACD is purchased, that the system will overload the air conditioning, for example, and will require major structural modifications that equal the cost of the communications equipment. All of these details should be discussed during the contract negotiations.

The acceptance test must be included in the installation portion of the contract. This section should spell out every step of the acceptance test procedure and specify that the acceptance is to be completed on the installed and working system some period before the actual cutover. The acceptance test section should also state which personnel will be involved in the test sessions. For a large site with a new release of software or a Beta test site, it is essential that a programmer be on site during this phase, or at a minimum, during the final days of acceptance through the first few days of cutover.

The acceptance tests will, at a minimum, include such things as a functional check of all features at each telephone, along with actually placing a call through the switch and answering test calls at each telephone. The acceptance tests should also check all major functional components of the system.

Power and Grounding Systems
Network and Signalling
Peripheral Equipment, CRT's, Printers
Tone and Digit Switching
Trunks
Conference Circuits
DTMF Senders and Receivers

The vendor's management personnel will not be able to correct any faults which the acceptance test uncovers unless there are competent diagnostic programmers on the site. It is usually not necessary to make the same requirement for hardware personnel, as the installation phase will generally find and correct any hardware problems. If an automated diagnostic routine is to be run as part of the acceptance test, this should also be specified in the contract. Generally each manufacturer will have a diagnostic subsystem which can check all major pieces of equipment, stations, and circuit cards. This diagnostic routine should be run and the results verified by the customer before the equipment is accepted. All software features should be tested under load if possible to insure that there will not be a failure once the call volume reaches production levels.

A complete installation includes the requisite training to operate the system. The contract should detail what types of training are available and any charges for additional training. There is a high turnover rate in the communications field and this additional training is essential for an effective center.

The warranty agreement in the contract should provide a period of free maintenance and correction of any hardware problems for up to one year, with a more limited warranty on the software. The software warranty will vary from vendor to vendor because software is so expensive to fix. Most vendors will not sign up for a one-year software warranty. The service costs should be clearly spelled out, along with the expected delay between a failure report and the arrival of the repair crew. There should be some penalty attached if the service crew fails to respond within the specified time period. Many vendors guarantee two-hour and four-hour oncall maintenance, but there is no penalty provision in the contract if the repairperson decides to have an extra cup of coffee or finish watching a movie before driving to the site.

In addition to the time guarantees, it is essential

to spell out in the contract what training the service personnel will receive and minimum competency standards. There should also be some procedure established for removing the vendor's personnel from a site. There are some site engineers who are just not compatible with certain customers. Removing them can be difficult if there are no established procedures.

A final section of the contract should outline the consequences of the vendor's failure to install the ACD or the buyer's decision to cancel the order prior to installation. This section should also detail the recovery mechanism in case damages are incurred during installation.

SERVICE AGREEMENT

The service agreement should be covered in the proposal and purchase contract. Both the hardware service and software service should receive some mention.

In the case of equipment purchased from a distributor, it is wise to have both the manufacturer and the distributor sign the contract. At a minimum the manufacturer should agree to take over the support service should the distributor fail in this service responsibility or go out of business.

The service agreement should specify who will do the maintenance, how long it will take to get service, and spare parts availability.

Generally the manufacturer should provide a two-hour on-call service for an ACD which performs critical functions. The two-hour on-call agreement will cover minor failures, diagnostic warnings, individual trunk or station failures and items which causes less than 10% of the switch to be non-functional at a given time. Any failures which cause more than a 10% failure or that actually prevent the answering of calls should be covered under an emergency agreement that specifies best efforts to dispatch a technician to the site immediately.

The service agreement should provide for parts, software availability, and service for a five-year period past the purchase date of the equipment. Most telecommunications equipment is justified on a three-year cash flow basis and depreciated over a five-year

period. As long as the manufacturer provides parts and support over a five-year period, any residual value in the switch will already be written off the books in the event that the switch vendor eliminates support for the model installed at a given site.

Nearly every vendor will state that such a provision is not a part of their standard agreements--which is true. The knowledgeable purchaser, however, never signs the standard agreement.

Consider the contract language reproduced below which represents the "standard language" from a major ACD supplier. Try to find at least eight major problems with this contract section and then decide whether you would sign that piece of paper. Keep in mind that nearly every provision that seems objectionable undoubtedly has been changed by at least one determined buyer.

Section 8 Software

"Software, documentation and other information owned by the vendor and its suppliers and provided to customer by the vendor for control of or use with product provided to customer under this agreement or under subsequent orders placed under this agreement shall remain the property of the vendor."

Section 17 Price and Payment -- Purchase

"The product price listed on the Purchase Supplement may vary by not more than plus or minus 5% for unforeseen configuration and or technical changes. Otherwise, the product price listed on the Purchase Supplement is not subject to change unless Customer postpones the installation/delivery date for more than thirty (30) days."

Section 20 Warranty Exclusions

"Except as specifically made herein, the vendor makes no warranties, express or implied, and specifically disclaims any warranty of merchantability for a particular purpose."

Section 21 Exclusive Remedies and Limitations

"Except for delays in installation of thirty (30) days or more, Customer's sole remedies against the vendor for loss or damage caused by any product defect or failure, or arising from the performance or nonperformance of any

work under this Agreement regardless of the form of action, whether in contract, tort including negligence, strict liability or otherwise, shall be (i) Customer's right to receive the repair replacement or refund set forth in Section 19A of this agreement, (ii) Customer's right to terminate as set forth in Section 22C and (iii) the lesser of the amount of actual direct damages which are proven or $ 50,000. If installation is delayed by thirty (30) days or more by causes not attributable to the Customer or force majeure conditions then Customer's sole remedy shall be the right to cancel the order without payment of any cancellation charges."

Section 22 Termination and Cancellation

"Upon termination of this Agreement or any orders hereunder, Customer will make the products provided under all affected orders available for removal, which shall be accomplished in a careful and reasonably expeditious fashion. The products will be returned in the same condition as originally installed, ordinary wear and tear excepted, or Customer will pay for restoration of the products to such condition. Vendor shall be liable to restore the premises to their original condition."

Section 25 Modification to the Agreement

"Any supplement to or modification or waiver of any provision of this Agreement must be in writing and signed by authorized representatives of both parties, except that the vendor may, upon ninety (90) days prior written notice to Customer, modify the terms and conditions of this agreement. Variances from this agreement in any Customer order shall be of no effect."

It should be clear after skimming through these examples that any contractual documents should be thoroughly analyzed and negotiated. The standard contracts supplied by all the vendors are solely for purposes of starting a discussion and most clauses will require some negotiation.

In the event that a switch is purchased from an unknown or small supplier, there should be provisions for turning over maintenance of the switch to a third party in the event the original manufacturer dclares bankruptcy. Many third party maintenance organizations like Western Union, RCA, Sorbus, etc. will provide maintenance services if they are supplied with equipment drawings, electrical schematics, specifications, and spare parts. A contract provision should insure that these items will be turned over to a third party at the appropriate time.

A PABX which stops functioning may not be a critical failure. People will call most establishments back the next day. The office staff can take a breather for the afternoon. If an ACD ceases to function it is a catastrophe. The concentrated revenue-production at the ACD means a great deal of money will be lost for every minute the system is down. For this reason most of the larger, more sophisticated ACD's will provide redundant processors and central control equipment.

The service agreement should state how long an emergency service response will take, the costs of such services, and the location of spare parts and personnel to handle an emergency. Spare parts should be located on or near the customer's premises and should include a spare for nearly every major equipment complement in the ACD. Regional spare depots are not very useful considering the length of time required to arrange delivery to a site.

The ACD should also have remote diagnostic capabilities which allow the vendor to dial up the customer's processors and diagnose equipment problems.

It is prudent for the buyer to understand what types of repairs the site engineer can accomplish and what things will require factory personnel to be sent. Sending a few of the manager's own staff through the vendor's maintenance course is a simple way to acquire this understanding. Often these courses are difficult to schedule and expensive, but they are very worthwhile. At the completion of these courses, which may last three to six weeks, your personnel will gain a general understanding of all of the detailed things that the vendor must perform to keep your switch operational.

It is also critical that one or two people on your staff understand the electrical characteristics of telephone interfaces and circuits in order to point repair personnel in the right direction. The accepted practice in the industry is to assume that the switch is the point of failure first, and after that possibility is eliminated then call the telephone company repair center.

Your staff should be able to operate a telephone installer's handset and some simple test equipment to measure line impairments, voltage levels, current in the local loop, and other basic items. Insuring that your staff possesses this basic level of knowledge will help prevent disagreements between the switch vendor and the transmission company.

SOFTWARE

There should be some provision for the buyer to receive standard product line software enhancements for the cost of a system load or tape build. Vendors constantly enhance the ACD's software through standard and optional catalog items as well as through "internal" fixes that do not appear in the catalog. All of these "internal" fixes should be available to the buyer provided the buyer purchases any additional pieces of hardware necessary to implement the changes (such as additional memory). If the vendor will specify a tradein allowance, this would be useful to include in the financial section. Of course, it is doubtful the negotiators could make an accurate prediction of the system's financial worth at the end of five or eight years.

The primary difficulty in maintaining a digital ACD is the software. This is one area where it is impossible for a person with "general" knowledge to find and fix a problem. Specific information is required (program listings, memory maps, a test bed, software build listings, software library modules) to even find a problem. This is an area best left to the manufacturer and trained service personnel. However, the vendor may go out of business. To be prepared for this possibility, the contract and the service agreements should provide for software documentation and training, at a set fee, should the manufacturer withdraw from the market. This fee will seem exhorbitant in most cases, but the training could allow a group of customers to turn their systems over to another company.

DOCUMENTATION

Along with the description of all features, the vendor should supply a complete set of documentation covering the functional operation of the software and the hardware, the requisite service manuals, a complete set of wiring diagrams, and the parts lists for the diagrams. Companies may find that the equipment must be specified in accordance with the Underwriters Laboratories Code. Electrical workers in many metropolitan areas will not install equipment which is not UL registered.

A lot of equipment is being sold with hopelessly inadequate documentation. This subject should be broached and answered early in the vendor selection process.

The buyer should receive a complete set of manuals that cover the operation of all the OEM equipment used in the ACD and a complete set of vendor manuals detailing the operation and features of the ACD software. All of the commands for the ACD should be clearly stated, along with the error codes and conditions. Each function should have a documented explanation and an operator's manual. The vendor's training department can often supply a book which lists all of the commands and the operating capabilities of the ACD.

The documentation should not be viewed as a limiting factor if you or your staff has the expertise to enhance functions in the system beyond the manufacturers stated capabilities.

One communications manager needed a circuit which would allow the automatic diversion of calls from New York to St. Louis when the New York site was placed in night service. The vendor was contacted and he explained that this facility did not exist. The equipment could not perform such a function without the purchase of a special option. Repeated discussions with the software department, the engineering department, and the marketing department established that this function was not possible without custom software or the purchase of an expensive option with many other unnecessary features. The communications manager continued to insist that it could be done. Finally the vendor suggested that the manager "just hook it up and see what happens." The "special" circuit worked flawlessly.

In another case a customer wanted to install an agent console at roughly twice the manufacturer's recommended distance from the central switch. The engineering department insisted that the specification could not be exceeded, but the installation group laid the wiring and had no trouble with the remote console.

If any particular specification does not match the operating requirements of an ACD application, it is always worth while to ask again and finally to experiment. The specifications are generally designed with an engineering margin to insure adequate service under adverse conditions. If conditions are not severe, the specifications can sometimes be exceeded.

The manager who needs a special piece of equipment should not hesitate to consult with the engineering department, outside consultants, or other equipment

manufacturers to discover solutions. The vendor should always be notified in these cases, and the contract should be carefully reviewed to insure that no warranties are violated. Often a simple solution may be found in plug-compatible equipment outside the ACD vendor's store.

The telephone companies are particularly creative in this regard with their own purchased equipment. Of course, their extensive engineering staffs have greater resources with which to recover from the experiment, but this is an area which deserves some thought. Many ACD sites have installed automatic answering devices, peripheral equipment, slave printers, slave video monitoring equipment, etc., which have appreciably enhanced the worth of their ACD.

GSA-PBS-FTS-2000

CHAPTER SEVEN

CUSTOM SOFTWARE

Only one warning need be stated, and restated, about custom software. Don't plan it, don't buy it, don't install it. Programming is a marvelous discipline. With a few simple changes, a word here or there, a number or two altered, your ACD can be doing something none other in the world can--and that you'll continue to pay for during the life of the switch.

One ACD management staff installed a custom dialing plan which would allow agents anywhere in the network to dial other departments by a recognizable acronym code. If someone wanted to call the training department in Los Angeles they would key in "TRLA." It was an ingenious system, but every time a department moved it required the creation of new tables to coordinate the actual phone number with the abbreviation. About $ 100,000 was spent every year getting the manufacturer to build new tables.

Custom software is also difficult to maintain. Each vendor has a library of generic software programs and a library of the programs which are running at each customer's site. These libraries contain the customer configuration and any vagaries in the standard and optional features at that site. Writing a software program is much like flying from Atlanta to Salt Lake City. There may be any number of ways to get there, but only one optimal route. Because of the variety of ways that a program can be written, not everyone can read the programs that someone else has produced. Since programming for a real-time machine like an ACD is complex, there is always the chance that some arbitrary combination of events will crash the entire operation.

One computer system was put on the market some years ago which would cease operating at a specific time on a specific date because of a glitch in the way the operating clock was interpreted by the software. If this had not been caught by a mistake (someone accidentally set the clock ahead by three months), every computer of that type would have dropped dead simultaneously.

If there is a piece of custom software in your ACD,

there will be extra time and expense required for its repair. The problems of your unique system just will not be understood as well as that of standard product line software. If there is a special feature which seems essential to the effective operation of the ACD, then every effort should be made to convince the manufacturer that your request become standard product line software.

Every vendor has facilities and procedures for upgrading the generic software in the ACD at regular intervals. Any custom feature or special item can become a part of that generic enhancement if there appears to be sufficient interest and a reasonable profit margin. In some cases it may be best to purchase the ACD and then lobby among the vendor's other customers for the software enhancement. Often just holding out on the sale will be sufficient incentive to coax a new "product line" item from the vendor. The major advantage of obtaining a product line software enhancement is that the development cost might be shared among several buyers and, more importantly, that feature will continue to be enhanced and supported along with the other product line items in the next software release. Custom sites often fall behind and either lose their feature with the next release, or find themselves unable to install the new software.

Either way, custom software is rarely worth the price unless it is clearly cost-justified and the communications department is fully willing to carry the additional costs throughout the life cycle of the equipment.

There is one important exception to the caveat about custom software. There are some very significant changes that should become available to the telecommunications community in the near future which will provide some of the sophisticated technological facilities common in the data processing industry.

None of the telecommunications equipment on the market is user programmable, with the exception of some routing tables or phone feature tables. The next generation of telecommunications equipment will provide an applications programming area in the switching equipment that will actually allow users to custom engineer the switching functions. The initial seeds of this development are already evident in the customer formatted report packages pioneered by AT&T and developed further by Rockwell International, as well as other manufacturers

These user application areas will allow the development of programs that actually control the switching function. Some obvious applications would include things like telemarketing programs which routed calls to specific agents based on the telephone number dialed by the caller. Computer interfaces could be established that would generate custom agent displays based on the type of call being handled. Automatic reports and sophisticated interfaces to the intelligent networks that AT&T is introducing through Enhanced 800 Service and the Integrated Services Digital Network will be possible with this enhancement.

Once capabilities of this sort are available, telecommunications departments will require programmers just as the data processing departments currently do. The benefits to creative users who aggressively develop applications that meet their communication needs could be enormous. The inevitable integration of host functions and PABX functions in the automated office will require that the telecommunications equipment of the future be able to accomodate rapid changes in software functions and switching capabilities. These user programmable switches will provide the communications department with another resource to insure cost-effective, sophisticated services to the company.

CHAPTER EIGHT

SELF-MAINTENANCE

Armed with a complete kit of spare parts, an on-site engineer with minicomputer background and vendor training, and a regular shipment of the vendor's internal and OEM documents, a large ACD user can maintain the equipment at less cost and with better service than the vendor can supply.

The only thing that cannot be handled is the software. There is virtually no way that a part-time software maintenance staff can understand, diagnose, and repair software problems. This is a job for people who work with the software every day and have at their disposal a complete development system and an ACD test bed.

Do-it-yourself maintenance on the hardware may be a good buy. The maintenance contracts on a large ACD can easily run from $1500 to $3000 per month. For this price an extremely competent engineer can be hired to take over the maintenance function for the ACD and other data processing equipment. Generally at least two people should be hired for a self-maintenance program to insure coverage during vacations, illnesses, and turnover. A person with a two-year degree in electronic technology or electronic equipment repair is usually qualified enough to successfully attend the vendor's maintenance schools.

If the ACD manager starts a self-maintenance program, and there are many who are doing it quite successfully, there should be an agreement with the vendor to provide updated engineering notices on a regular basis, along with additional training courses when a major change occurs. The same spare parts which are available to the other users should be provided to the self-maintenance customer and at the same prices. The manager should not try to cut costs on the spare parts inventory. The initial purchase of the spare parts can amount to sixty percent of the total ACD purchase price, but each spare is critical and a complete inventory should be maintained.

Once in the self-maintenance program, most users

discover what the vendors have known all along. Less than 10% of the maintenance involves technically complicated and sophisticated analyses of elusive problems. Most of the maintenance effort is expended putting new cords on phones, moving phones to the other side of an office, and replacing bulbs or lamps in the display consoles.

Since the agent consoles receive the most use, a great majority of the time is spent with these instruments replacing key caps and fixing frayed cords.

There are occasions where very complicated repairs will arise and at those times it is often helpful to hire the vendor as a consultant to identify the problem--which is often much easier to fix than it is to find.

CHAPTER NINE

INSTALLATION

The installation phase begins with the site survey shortly after the contract is signed. The site survey will determine the facility requirements for the ACD equipment room and any additional work which needs to be completed on the power supplies and air conditioning. The site survey also provides the final list of materials for the ACD center and the preliminary wiring diagrams for the system center. In the case of the smaller ACD's this survey may not be necessary. Some of the ACD's at the very small line sizes can be wheeled into an office area, take up about the same space as a few filing cabinets, and only require interconnection with the distribution frame to begin operation.

The installation procedure should be laid out in a complete project plan. During the period of time between the order and the installation, all of the system designs and the line interface requirements should be reviewed. This is a good point at which to meet with the telephone representatives, explain that your company is buying equipment, and ask for advice on any additional circuits or equipment the telephone company, as the interexchange carrier, will have to provide.

The telephone company should be totally aware of any additional load which the ACD installation may put on the serving central office. The installation of several large ACD's in Los Angeles over the past two years nearly brought the central offices to a standstill. With adequate warning the telephone company can provide the facilities required to handle the additional traffic that an ACD can draw.

There are considerable lead times on new circuits so it is best to plan as far in advance as possible to order these circuits. Some of the telephone operating companies are experiencing a critical shortage of termination cards and other equipment needed to implement new facilities. Large orders will require significant advance planning. In the Post-Divestiture environment orders are inevitably delayed if they require the services of an interexchange carrier. A bundle of FX orders placed with AT&T that contains more than eight circuits will be placed on a special

project status, which does not imply expedited service.

The vendor should provide a complete timetable for each of the installation steps. With this schedule the training and staffing programs can be coordinated.

A typical milestone schedule, as opposed to the detailed project plan, will include the following major events:

Event	Elapsed Days
Execution of Agreement	1
Finished Equipment Room	30
Electrical & Environmental	45
Cable 75% Complete	55
Delivery of Hardware	75
Cutover of System	90
Acceptance Test	120

The vendor will request a letter of agency from the customer which will allow the vendor to coordinate the placement of orders with the local companies and exchange carriers.

Once the installation cycle is complete, the equipment still needs to be tested by the customer to insure that all functions are operating as advertised. This step is known as the acceptance test.

The acceptance procedure is one step that requires complete concentration and maniacal attention to detail. Unfortunately, the acceptance procedure takes place at a time when no one is emotionally prepared to provide the energy it demands. The acceptance test occurs in the last one or two weeks of the entire selection, purchase, negotiation, installation, and training process. The acceptance test will run right up to the time of cutover, and at this point everyone wants to turn the system on and try out the new toy. The salesman may plan a party which everyone is eager to join. In addition, there will be pressure from upper management to accept the ACD, as well as the arrangements with the telephone company for swinging the new trunks into place.

The only sensible approach in all this is to allow sufficient time for the complete acceptance test. In a large ACD with a complete acceptance test procedure, it may take up to three weeks to push all the buttons and check all the reports. This may be three weeks of fourteen-hour days. Not one detail should be overlooked. Every item should be checked while the system is operational but not under full load. At this time it is easy to identify problems, and more importantly, the vendor has money hanging in the balance.

The manager should have examined the acceptance test prior to signing the contract and agreed with the level of detail in the test. In most cases the test will turn up items that are incorrect. If an option will not work or a termination is incorrectly identified, the acceptance test should find and correct all of these problems.

One part of the acceptance test procedure which most managers fail to consider is a check of the software listing for their site. Each vendor will have a set of forms which the vendor and the customer fill out together detailing the configuration and interfaces within the site. This form is then keypunched and used to produce the actual software delivered to the customer. Errors can occur in this process. The manager can save a great deal of trouble during the acceptance test by reconsidering the configuration input after the software listings have been generated. Any discrepancies between the options list and termination tables can be straightened out by the vendor before the software is installed at the site.

The acceptance test should check the following:

1. all call-handling capabilities and features at each agent set and on each trunk;

2. all reporting capabilities with timed correlations between staged calls and the accumulated report fields; and

3. all diagnostic functions. This procedure will involve placing a call on every trunk in the system and at every agent set in the system.

For a large ACD with tandem and PABX capabilities built in and several hundred different operational capabilities, this is going to take considerable time

and effort--time and effort well spent. It may take months to find the problem once the system is under a full workload.

The manager should also be aware, and should not be surprised, that there will be problems. A conditional acceptance is possible, with exceptions noted for small items, in order to complete the cutover on schedule. This should not be allowed where there are major problems, but the minor things can be cleared up without too much trouble by the programmers on site during the cutover.

The primary consideration for a successful cutover is a good working relationship with the local telephone operating company. The cutover requires considerable coordination between the vendor and the telephone company. During this process the trunks from the old equipment are disconnected and reconnected to the newly installed ACD. The trunks are moved one at a time in order to progressively increase the load on the system and to individually test the performance of the circuits.

During the cutover period, the vendor should have both hardware and software personnel on site. There will always be a few bugs in the system that can be discovered only if the system is under a live traffic load. Some cases will not require any hardware personnel, but a few programmers should always be available.

It is also sensible to provide some additional direct telephone lines to the facility in case the new communications equipment fails. A successful cutover requires a considerable amount of pre-planning. The cut should always be scheduled for a low-traffic period, on a weekend or at night.

PART III

DEFINING THE ACD ENVIRONMENT

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CHAPTER TEN

SYSTEM GOALS AND SPECIFICATIONS

There are several external and internal factors of which the ACD manager should be aware to effectively run an existing communications center or to install a new center.

The external factors can be divided into two related spheres of influence: the corporation and the outside world. The outside world is the set of all influences which affect, but are not directly a part of, the corporation. This refers to the competitive and regulatory arena within which the corporation must work. The ACD manager will have little influence over external problems, but it is critical to understand the regulatory nature of the ACD's outside environment. In this era of increasing competition each manager is well-advised to study the FCC regulations governing telecommunications.

Many ACD's, especially those within the utility companies or regulated monopolies, are governed by a public utilities commission or outside governing body responsible to the state legislature. Because these regulatory bodies may be empowered to enforce various levels of service and the type of reporting that is necessary, their requirements should be studied in detail. Governing commissions which enforce a particular service level often have different requirements for determining the reported level. A commission which demands that ninety percent of all calls be answered in less than ten seconds may seem rather strict--until it is discovered that this average speed of answer can be figured over all the hours of ACD operation and that the commission assumes "all calls" to be those handled, rather than those offered, at the ACD.

Understanding the regulatory environment should also extend to the legal technicalities of managing the agent staff. An ACD is prone to several types of staff problems. There may be union labor or non-union labor available, depending on the application. In some cases it may be worthwhile to investigate moving the ACD to another location or building a center in another town to take advantage of fewer labor problems, lower cost

labor, non-union labor, or higher quality labor. In an ACD application with highly technical or intricate answering responsibilities, it may be necessary to locate the switch in a university town with a large population of educated workers. For a union shop it may be necessary to consider what types of reports can be gathered without violating the labor contract. In some cases union regulations will prevent the gathering of individual performance statistics on the agents. Special monitoring and recording of conversations are not allowed under the laws of some states or the regulations of various unions.

The principal internal demands are the stated service levels and the operating budget for the center. The operating budget will usually reflect whether the ACD is a revenue-producing operation or an expenditure center. An expenditure center is one which provides a service to the outside world as an adjunct to some other revenue-producing activity without directly charging for, or realizing, a profit from the transaction.

For the airlines this would include all of the calls from eager groundlings checking and re-checking the anticipated arrival time of delayed flights. In the telephone industry the Directory Assistance function is an expenditure type of ACD operation. The telephone company has to provide assistance in order to run their business, but they would rather not since local assistance calls generate little revenue. The airlines would rather not have people calling in for flight times, but this is a necessary cost of business.

A revenue-producing center handles those calls which generate some type of sale--whether that be record albums or catalog sales. Typically, any ACD will have a mix of revenue and expenditure functions. One gate will be set aside to handle revenue functions like selling tickets, and another gate will provide information on flight arrivals or some other service.

The corporation will usually set different service level requirements for each type of gate. The manager should be aware of the service levels expected by the corporation, the terms they are expressed in, and the resources that are made available to meet those service levels. The service level will usually be expressed as a function of the percent of calls answered in so many seconds, i.e., 90 % of all calls in ten seconds or less. If different service levels are set for various gates, the manager should be aware of this, understand how the

level was determined, and the justification for its establishment. There will also be, in all likelihood, a specification as to the number of calls which can be blocked or abandoned per gate and some figures on the blockage factors for incoming trunks.

The manager should also identify the types of reporting that are required by upper management and analyze in detail the formulation of these reports. Often the ACD manager will be working with a set of required management reports that do not match the reports that are produced and printed by the administrative data system integral to the ACD's software system. An understanding of where these two reporting requirements differ and where they intersect is critical to effectively representing the operation of the switch to management.

If the reports produced by the ACD and those needed by management are dissimilar, a great deal of hand labor will be required to translate the machine reports into the accepted form. In this case every effort should be made to educate management as to the types of reports that are readily available. There is often no compelling reason why upper management has chosen the reporting structure to which the ACD manager must conform. The reporting structure will often be the last vestige of an outdated ACD which provided the information in a certain format that was eventually incorporated into the required periodic reports. Most of the call-volume reporting that is passed along should be photocopied from the printed records just as they are, summarized on the ACD reporting system. There would have to be a very strong rationale to justify the enormous money some companies spend to have two or three analysts translate and transcribe numbers from one report onto another for two or three days out of each week.

After considering the constraints and requirements of the world beyond the corporation, and the corporation itself, there remains the task of identifying the configuration and goals of the ACD system.

NETWORK MAP

When defining the operating environment of the ACD center, a network map is needed to understand the overall operation of the switch and the potential for replacements within the trunking matrix. The map is an

TRUNK MAP

GATE ONE

Cost - 28¢ per call
Revenue - $90 per call
Calls handled - 6000/month
Avge call handled - 220 secs
Avge speed of answer - 5 secs

800-351-0256 FBD Band 5
800-351-0257 FBD Band
800-351-0258 MT Band 5
800-351-0259 MT Band 5



GENERAL SALES

GATE TWO

Cost - $600 /month
Revenue - $85 per call
Calls handled - 800/circuit
Avge call handled - 120 secs
Avge speed of answer - 10 secs

743-8190 Tie-line
743-8191 Tie-line



RESERVATION

GATE THREE

Cost - $35 /month
Revenue - $0
Calls handled - 400/circuit
Avge call handled - 290 secs
Avge speed of answer - 20 secs

389-5143 Local
389-5144 Local
389-5145 Local



EXECUTIVE

GATE FOUR

Costs - 14¢ per call
Revenue - $25 per call
Handled calls - 5000
Avge call handled - 145 secs
Avge speed of answer - 20 secs

421-8456 FX Kansas City
465-8756 FX Chicago
576-9586 FX St Louis
567-8896 FX Colombia
497-9263 FX Canton



TOURS

invaluable tool for maintenance and equipment ordering.

The "map" should be somewhat along the lines of the chart in the Figure III-1. This type of organization, altered to fit the requirements of the individual ACD, should list all of the incoming and outgoing trunks which terminate at the ACD. This will include the WATS lines from the central office, the tie lines and intermachine trunks, the FX circuits, any transfer trunks between the ACD and foreign switches, the long distance circuits, and any specialized common carrier circuits. Each one of these circuits should be grouped in the diagram to show the gate or facility within the ACD it services and the functional identity of the types of traffic which each line, or trunk bundle, carries.

Along with this thorough accounting of the lines terminated at the ACD, there should be information filled in beside each trunk for the costs of the circuits and the revenue carried by each circuit. The cost/revenue figures are necessarily dependent on the traffic load for each circuit and this information, broken down by individual circuits and by trunk bundles within a rotary, should be entered on the chart. This will provide some clues as to the cost/benefit ratio in terms of traffic and revenue that any given circuit is providing. The cost figures for the trunks should include the mileage charges on each type of circuit and a quick look at alternative costs for other types of service. A few rules should guide the manager as the trunk analysis is done in order to more closely examine those circuits which seem uneconomical. These rules can be generated by the procedures listed throughout Part IV on the establishment of system parameters.

Tables describing the class of service on each trunk and the routing structure for outgoing ACD, PABX, or tandem calls should also be included in the analysis of the functional identity of the trunks within the ACD.

The entire subject of routing structures is heatedly debated in the communications industry. The manager should be aware of the literature about different types of queuing in the ACD and the different mechanisms available within the ACD for least-cost-routing. The class of service marks in an ACD allow the manager to restrict access to various trunk groups by different staff members within the ACD. Typically, agents are given the lowest class mark (or priority) and are only allowed to dial within the local numbering plan. Administrators may be given a class of service

high enough to allow direct dialed international calls. Whatever scheme is used, the class of service designation helps control the cost of outgoing traffic.

If the ACD is being used as a node in a multi-ACD load-balancing or tandem switching scheme, the load-balancing parameters and the amount of traffic experienced under normal and overload conditions should be examined.

In the case of a tandem network (not related to Tandem Computers) using ACD's as the switching centers, it is also useful--providing the expertise is available--to complete a study of the network loss plan. Many companies are still uncertain in this area and do not fully understand the circuit levels which are provided in a given situation. The ACD manager would do well to study this topic in the AT&T technical reference "Notes on the Network." An ACD operation may require precision-balancing over and above what might be expected from a cursory examination of AT&T's VNL plan.

The traffic and revenue figures should be supplemented by graphs of the service levels that each group of trunks connected to any particular gate is expected to meet. The service level on the trunks, in a multi-gate configuration, will probably be different for different bundles. A gate which generates a great deal of revenue per call should have a more competitive service level than a gate which primarily makes outgoing calls, or which handles general information requests that do not generate any revenue.

Service levels should be charted in terms of the percentage of time that all trunks within a group are busy and the percentage of time that the trunks within any group are carrying traffic. It is essential in an ACD operation to look at the percentages of all trunks busy in conjunction with the manning levels at the gate. The number of people who are active in the gate can have a great impact on the blockage level in the trunk reports. If a gate is understaffed, it is useless to increase the number of trunks to lower the blocking probabilities. More people will be delayed at the gate and wait longer in the queue. People will wait a very long period of time, get no answer from the understaffed gate, abandon the call, and be replaced by someone else who waits a long period of time and then abandons the call. The gate must be staffed at the proper theoretical and practical level in order for the blocking probability formulas to have any validity on the trunk groups.

The average handling time at the gate, as measured for the agents, is not a reliable number to use in trunking determinations. The average handling time does not include the holding time on the trunk generated by the interval in the delay queue. The agents may be answering a load of ten erlangs while the serving trunks are offering a load of fifteen erlangs. The five erlangs of lost traffic are held in delay queues for some period before hanging up. This traffic increases the load on the trunks, but contributes very little to the efficiency of the agents. The trunk holding times will be quite high, while the average handling time for the agents will remain constant.

In addition to these considerations, the manager must examine the reporting structure which is generating the trunk figures. ACD's are so easily reconfigured that trunks can be moved from gate to gate until they end up wildly out of sync with the proper reporting groups. There may be trunks in any particular group which are taking calls from several different rotaries and from several different gates. A general effort to correlate the trunk, agent, and gate assignments with the reporting structure should be undertaken.

At the other end of the line, the ACD manager should look at the termination of the circuit in distant locations. An examination of the central offices and their positions within the numbering plan may demonstrate that it would be more economical to terminate an FX circuit in a different portion of a large metropolitan area.

A thorough accounting should be made of all the equipment on site and the current charges for that equipment. The telephone company's itemized bill and any vendor's list of materials should be compared with what is on site and any discrepancies in billing should be rectified.

Many times the manager will discover that the night shift is using a completely different set of agent consoles than the day shift. In other cases there will be circuits which were ordered and paid for but not installed. The extensive reporting capabilities of the electronic ACD's allow for a relatively painless tracking effort on all of this errant equipment.

CHAPTER ELEVEN

TRAFFIC ANALYSIS

When using a PABX it is usually sufficient to line for a low blocking probability in the busy hour of the busy day for the year. Many PABX managers assume that the busy hour will contain 14 to 17 percent of the total day's traffic and develop the theoretical traffic patterns and trunking requirements based on that assumption.

In the ACD environment the daily and even the hourly traffic fluctuations should be known and the system adjusted accordingly for maximum efficiency in the face of any load. Many airlines with non-union personnel change their staffing levels hourly. General Telephone examined the agent occupancy every fifteen minutes to account for shifts in the predicted traffic pattern. Other ACD users run split shifts, variable period shifts, and use a part-time staff to match the staffing levels to the incoming traffic.

Nearly every ACD takes advantage of the seasonal and monthly traffic variations to install or remove incoming WATS circuits. With careful planning the manager can save considerable expenses by fine-tuning the ACD in accordance with traffic fluctuations. One communications manager has so effectively refined this procedure that the center obtained a per-minute charge on the WATS lines which is below the figure AT&T representatives said should be possible. The electronic ACD's allow completely painless changes in the number of agents assigned and the number of trunks or supervisors at each gate.

In order to perform this type of configuration management, it is necessary to thoroughly understand the ACD's traffic load, both incoming and outgoing. The traffic measurements described in Part IV should be applied to gain a thorough knowledge of the traffic flows and their distribution among the various gates. If the ACD is also being used in a multi-node load-balancing or tandem arrangement, the task becomes more difficult but still manageable.

If a new ACD is being installed, the traffic analysis is more difficult. Some information can be gained by looking at other sites of similar function and size. Additional insight can come from the telephone company records for equipment that was previously in place. The ideal situation is to work with an installed electronic ACD which has already generated reports over the period of the study. Failing this, more cumbersome methods will have to be used.

The traffic analysis should be as detailed as possible and include a set of graphs, like those in Figures III-4 through III-7, for the yearly, monthly, weekly, and daily traffic flow. These graphs should be constructed and studied until the ACD manager is confident the pattern has been found. This type of analysis over a long interval should indicate whether traffic offered to the ACD is increasing or decreasing. These long-term trends should be determined and predictions made for the eventual upgrading or downsizing of the ACD. The manager should pay particular attention to discerning which holidays and seasonal events affect the traffic load enough to justify additional staffing.

The traffic analysis will be quite similar to the work done for the network trunking map, and some of the same information can be used in both studies. Traffic analysis is discussed in more detail in a later section.

The traffic itself should also be identified by the gates to which it is directed and the functional identity of the call types within each traffic stream. The various gates will all experience traffic of a different sort. The traffic should be broken down in this manner to determine the call-handling parameters within each gate.

The functional identity of the calling traffic will show whether there are mixed functions within any one gate. For instance, a credit card authorization center may be handling complaint calls within the same gate that is answering authorization requests. This would lead to an imbalance in the call-handling times on the authorization calls as they would be averaged against the much longer time spent on complaint or security calls. This is a rather obvious example. The mixing of call identities can occur in a number of more subtle forms. In one case, a bank service center was handling seventy-five different types of calls within a single gate. For a variety of reasons it was impossible to

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YEARLY TRAFFIC ANALYSIS

Center Open 7 Days Per Week 24 Hours Per Day

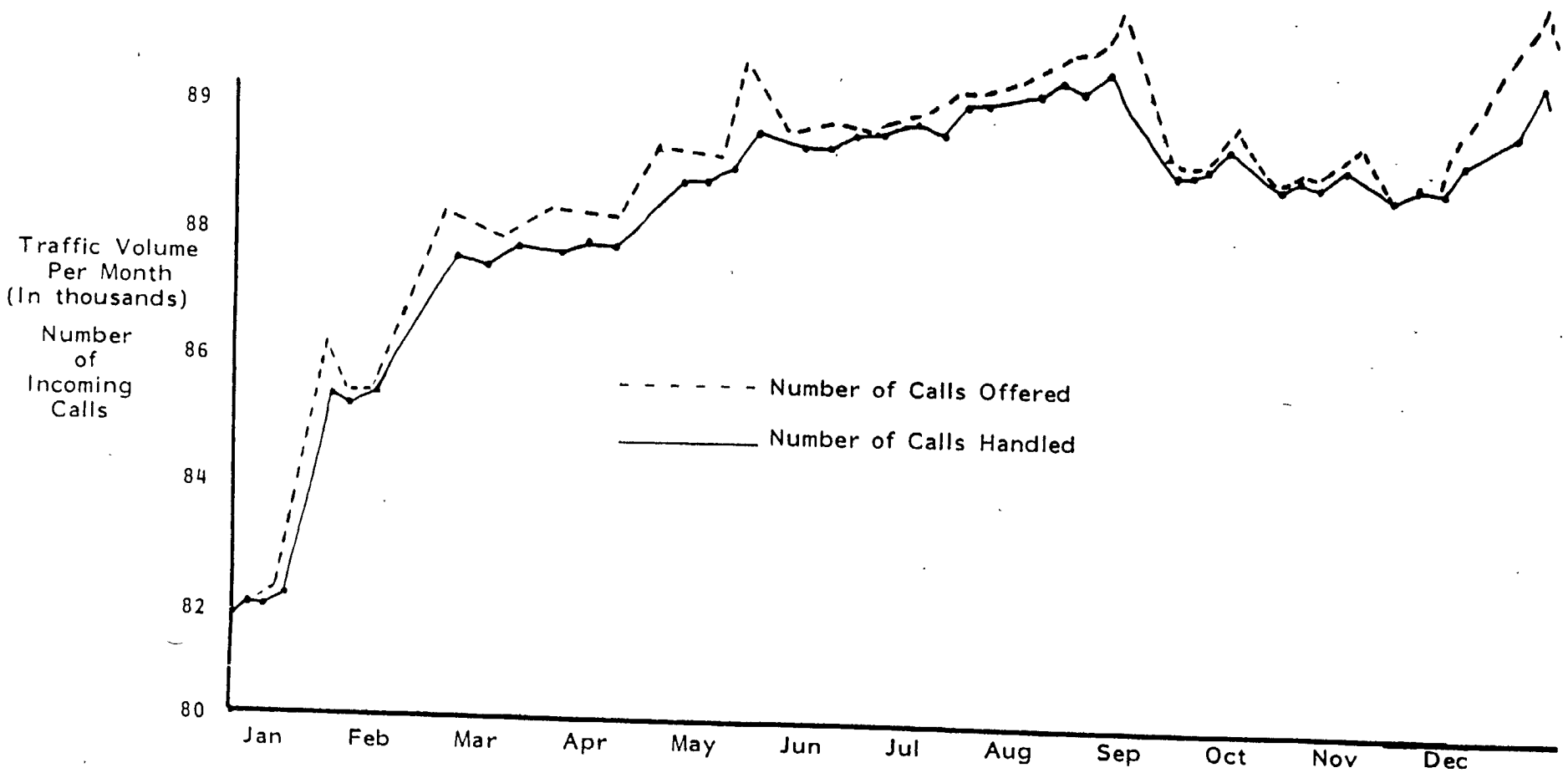


Figure III-4

[illegible]

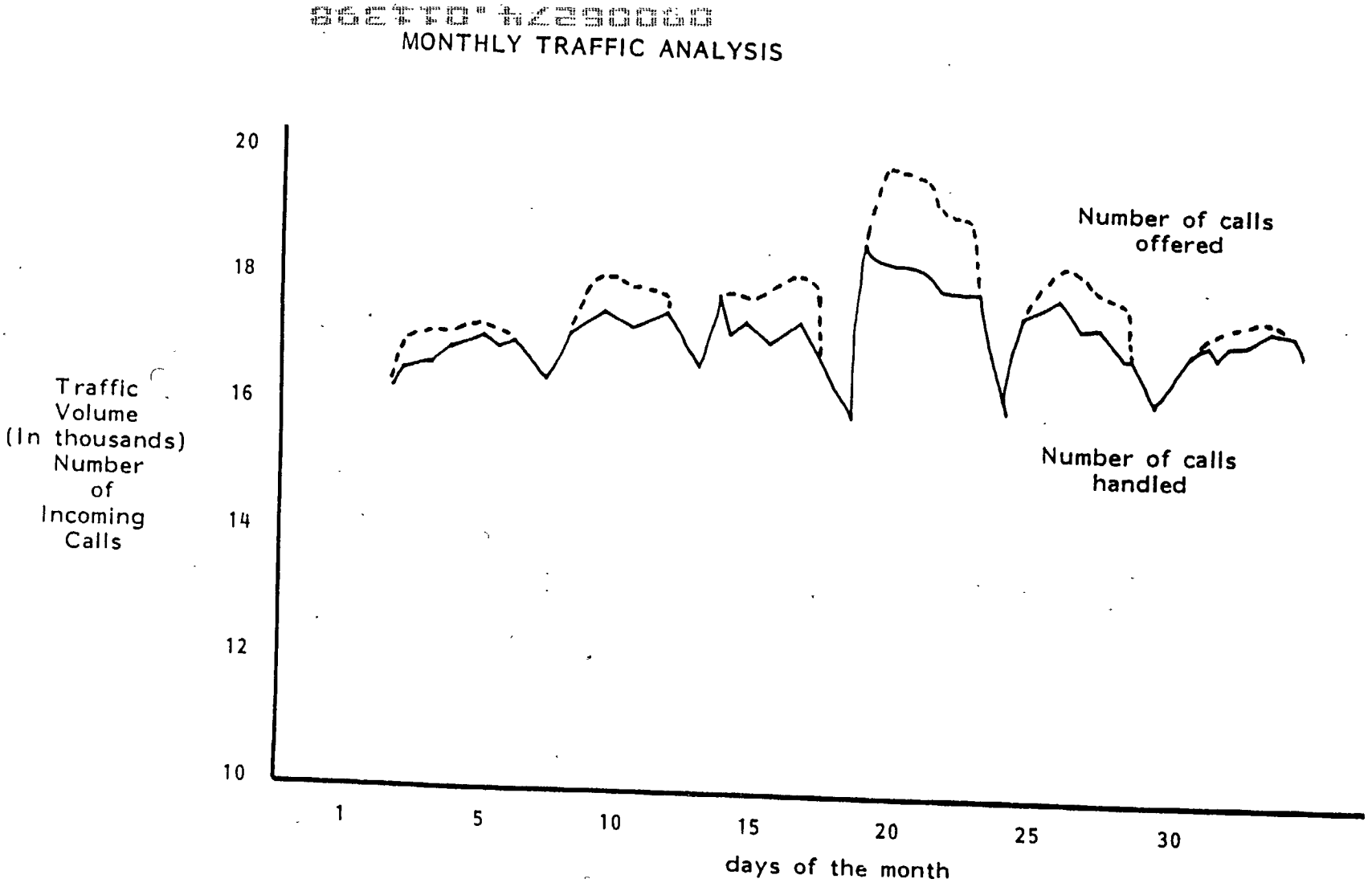

MONTHLY TRAFFIC ANALYSIS
Traffic Volume (In thousands) Number of Incoming Calls
20
18
16
14
12
10
Number of calls offered
Number of calls handled
1
5
10
15
20
25
30
days of the month

Figure III-5

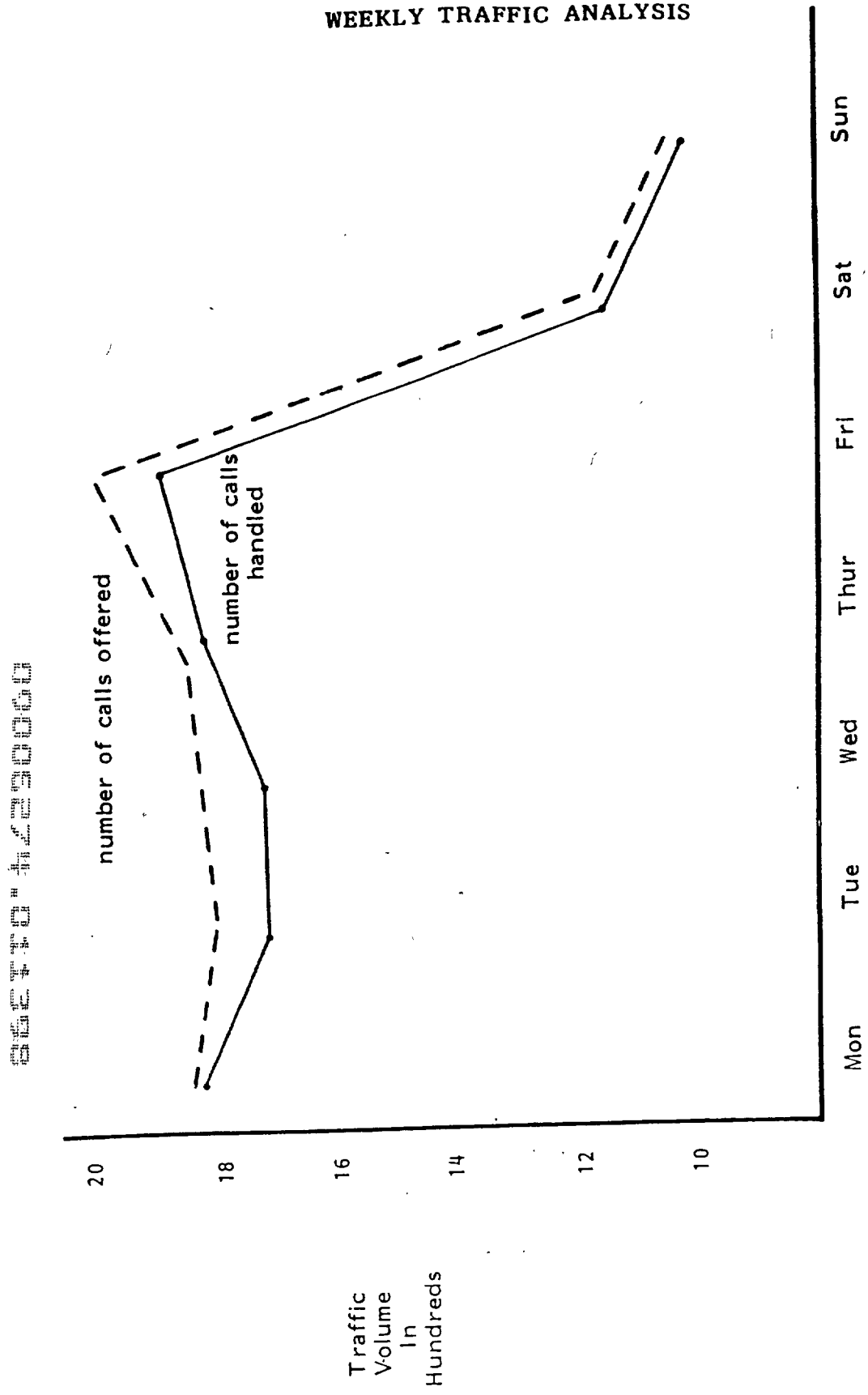

WEEKLY TRAFFIC ANALYSIS
number of calls offered
number of calls handled
Traffic Volume In Hundreds
20
18
16
14
12
10
Mon
Tue
Wed
Thur
Fri
Sat
Sun

Figure III-6

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DAILY TRAFFIC ANALYSIS

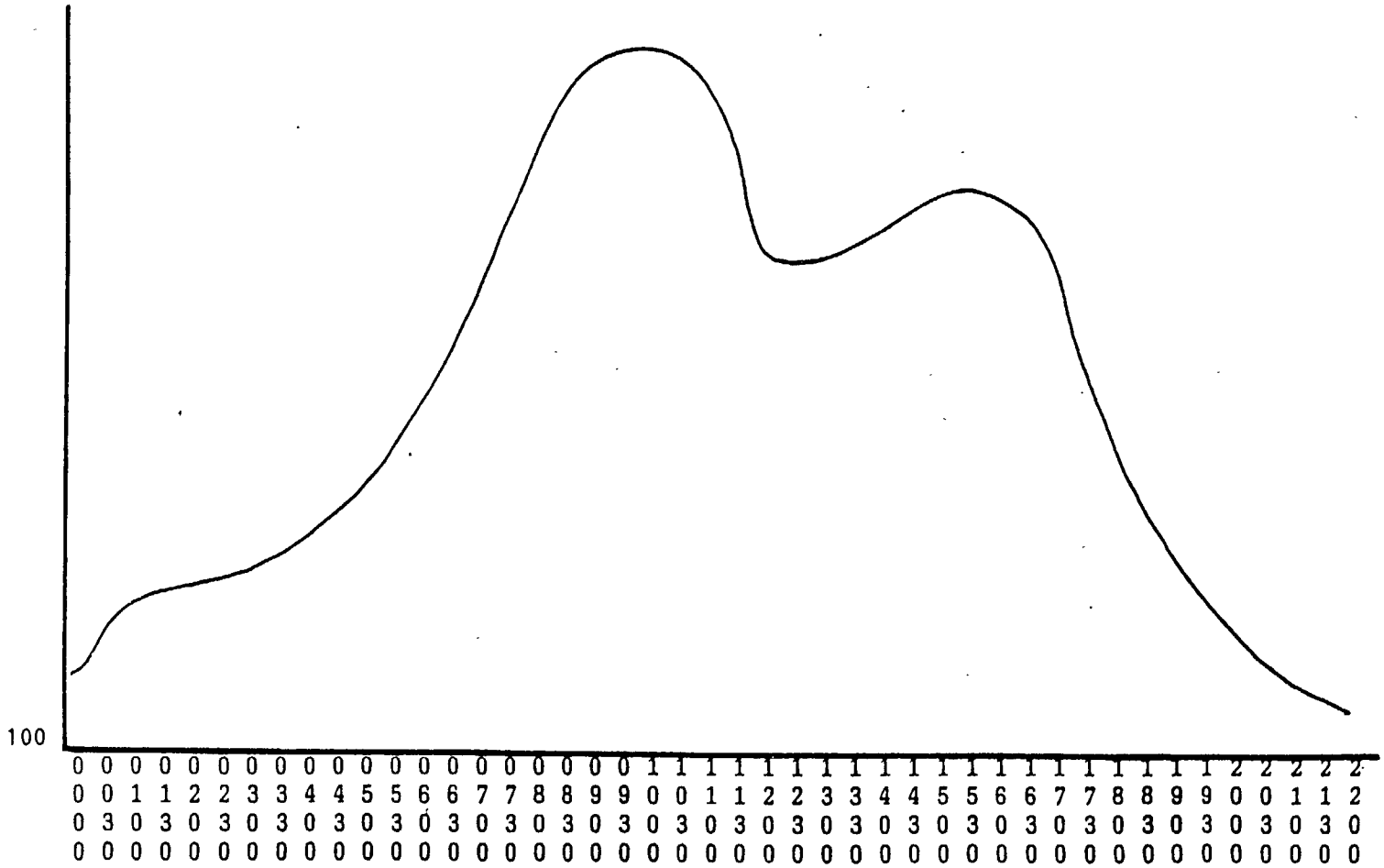


Figure III-7

separate these calling types into different gates. In other centers it may make more sense to break down this activity and specialize the agent's job responsibilities.

In addition to a study of the incoming call pattern, it is also useful to examine the internal calling pattern. If there is a great deal of transfer activity between gates or a lot of outgoing calls from one gate, it may be possible to reconfigure the trunking to make more efficient use of an agent's time.

The actual cost of each calling type, for each traffic stream at different calling volumes, should be used to summarize the results of the study. By combining this information with the service levels established for the different gates, it may be possible to make recommendations on more efficient calling patterns.

It is also essential to chart the call-handling statistics within each gate. The principal figures to examine are the volume of offered traffic, the volume of handled traffic, the abandoned traffic, the average speed of answer, the average delay in queue, and the average positions required to handle a given traffic volume. These figures can be used as a preliminary data base for setting the system parameters and redefining the service levels for each gate.

The long-range traffic analysis will contain the same type of information found in the traffic analysis, naturally enough, but will be mixed with the business projections for the company as a whole to establish the five- and ten-year operating plans for the center.

When performing this analysis, the ACD manager will need the assistance of the finance and marketing departments to acquire an accurate picture of the expected business growth over this period. The volume of traffic that can be expected given any particular change in the corporation's income should be charted, with minimum and maximum trunking and staffing figures appended. This type of chart will allow for an orderly expansion plan and assist in the construction of new facilities. The manager should be aware of the lead times for equipment delivery, allowing plenty of room for error when ordering equipment.

This long-range view of the traffic should also examine the alternatives to the present trunking mix

given the projected traffic volumes over the ten-year period. A private microwave system or company-owned and installed telephone circuits may be economical at some point. The staffing levels required should be passed along to the other departments to assure adequate new personnel and training facilities. The addition of equipment to the ACD can often be coordinated with additional PABX or tandem facilities to improve the overall economy and operation of the communications center.

With advances in the available technology, there are now several alterative to handling transactions strictly by staffing an agent at an ACD position. Whenever an ACD expansion is contemplated, the center manager should consider the application of audio response equipment, voice recognition equipment, or specialized transaction data terminals as alternatives to adding ACD agent positions.

All of these alternatives are less expensive than the ACD because of the elimination of the human operator. In one very successful example of such an effort a major transaction processing service bureau migrated 40% of their volume from voice operators onto electronic alternatives over a two-year period. In this example over one-million calls a month were shifted at a considerable savings to the company.

CHAPTER TWELVE

ACD ENVIRONMENT ANALYSIS PLAN

The ACD Environment Analysis Plan serves as the guide for any ensuing work with the ACD. It is the basis for any procurement effort and the operating schematic for budgeting and staffing throughout long-range planning.

This plan should be an intensive effort with dedicated personnel--much like the so-called "Green Room" projects that some corporations use to organize major development expenditures. In fact, this effort could be approached much like the Strategic Business Plan undertaken by the Marketing and Finance departments of many major corporations. The size of the communications department, its budget, and the visibility of this department to upper management will determine the grand or impecunious scale of this effort. In many small departments this plan will actually be an internal effort by one or two people.

The approach presented here is very formal, but the same ideas will work on a smaller scale. In many small departments this plan will actually be an internal effort by one or two people. Similar information should be gathered, although the formal presentations will be eliminated. This study, however undertaken, should result in a comprehensive plan for the communications department that will become part of the capital budget and justify whatever expansion is deemed necessary for the current facilities.

For those companies with a multi-part communications department, including data and voice (with PABX, tandem and ACD functions all within the voice area), the plan outlined here for the ACD will be simply one part of the entire department's planning. Completing this plan may take only a week for a small department with a single ACD--or require a month of intermittent activity for an integrated voice and data system in a multi-node configuration. It is essential to limit the time available or untold thousands will be spent plastering pinholes and gilding edges.

This planning effort should involve the communications management personnel, the managers and

supervisors from the users group, and the necessary analysts from the finance department and the communications shop. Some caution should be exercised in such a venture. Business planning can become a morass of wasted money and paper, serving only to justify what has already happened while doing nothing to aid in the long-term operation of the planned system. Even an individual manager carrying out an independent definitional study of this type can become entranced by history and miss the pleasures of contradiction. Strategic plans are not made to be followed, they are made to serve as a focal point for informed discussion.

One approach should be to circulate a set of charts and questionnaires for the responsible supervisors to fill out, followed by a series of informal meetings to analyze the results, discuss areas of overlapping authority, and suggest improvements in the operating efficiency and performance goals of the communications center. This is an opportunity for the upper level communications managers to grill their people and also to justify their ways and means to the departments below them.

Under no circumstances should any department be allowed to wander down its own crooked path. Planning is a cooperative venture. The give and take of information among the high level managers aids in the definition of the system. The environmental analysis will supply projections for a five-year period in most operational areas with a ten-year contingency plan covering only a few selected topics. The general five- and ten-year plans should serve as an aid to the development of operational budgets and yearly forecasts for equipment and manning. Long-range planning, however, cannot substitute for the day-to-day decisions that actually govern the ACD center.

If this suggested format is carried out, either as a group effort or by a responsible individual, it should provide some of the raw material needed to understand the ACD communications center and discover areas in need of improvement.

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SAMPLE LONG-RANGE STRATEGIC PLAN

This plan is to serve as the long-range strategic planning guide for the Brandaxe ACD Communications Center. This plan will address all significant areas of ACD operation for the next five-year period and will address selected topics for the ten-year period. A list of managers and their responsibilities to the plan are given in the outline below. The scheduled dates should be adhered to and each manager will be expected to present and justify their portion of the plan in a stand-up presentation to the communications department in one month.

PLAN REQUIREMENTS

I. System Description
- A. Performance Parameters
  - 1. Description for System
  - 2. Derivation of Parameters
  - 3. Justification of Parameters
  - 4. Alternative Parameters Considered
- B. ACD Configuration Map
- C. Network Configuration
- D. Traffic Analysis
  - 1. Current Traffic Analysis
    - a. Busy Days
    - b. Busy Month
    - c. Yearly Traffic Graph
  - 2. Five-Year Traffic Analysis
  - 3. Ten-Year Traffic Analysis
  - 4. Factors Considered
  - 5. High and Low Traffic Projections
  - 6. Business Growth Projections

II. Staffing Analysis
- A. Agent Parameters
  - 1. Description of Parameters
    - a. Handled Traffic per Reporting Period
    - b. Average Handling Time
    - c. Average Work Time
    - d. Average Unaccounted Time
  - 2. Derivation of Parameters
  - 3. Justification of Parameters
  - 4. Alternative Parameters Considered
- B. Staff Requirements
  - 1. Current Requirements
  - 2. Five-Year Requirements

PLAN REQUIREMENTS (continued)

III. Trunking Analysis
- A. Trunk Parameters
  - 1. Description of Parameters
    - a. Blocking Probability Cost Analysis
    - b. Blocking As a Function of Staffing
    - c. Traffic Volumes
  - 2. Derivation of Parameters
  - 3. Justificatiion of Parameters
  - 4. Alternative Parameters Considered
- B. Trunking Requirements
  - 1. Five-Year Plan
  - 2. Ten-Year Plan
  - 3. Justification and Analysis
  - 4. Trunk Map and Description
  - 5. Alternative Carriers
  - 6. Cost-Reduction Plan

IV. Network Analysis
- A. Network Configuration
- B. Load-Balancing Objectives
- C. Budget Allocations

V. Financial Analysis
- A. Capital Investment
- B. Return on Investment
- C. Cost Analysis for Five-Year and Ten-Year Projections

SCHEDULE

Day 1 — Presentation of Planning Period Objectives
The complete plan and the instructions will be distributed at this introductory meeting. All responsible managers and their personnel should attend.

Day 7 — General Discussion and Work Sessions
Each manager and their selected people should meet in separate working sessions to present their findings to date and settle on the areas of agreement or disagreement.

Day 14 — Committee of the Planning Session
This should be a general work session with all those involved present to review work to date and trade information where necessary on business growth versus traffic projections or staffing needs as compared to trunking requirements.

Day 21 — Informal Presentation
This session, with all the managers present, should be used to review the nearly completed charts and exchange information.

Day 28 — Formal Presentation
At this session the upper management should be present and the formal recommendations and questioning should be undertaken to finalize the plan. Upper management should approve the plan at some point after this and use it as part of their edicts.

PART IV

PERFORMANCE PARAMETERS

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CHAPTER THIRTEEN

ELEMENTARY TELETRAFFIC ENGINEERING

At the heart of teletraffic engineering there is a great deal of sophisticated mathematics--probability theory, stochastic functions, etc. Fortunately for the ACD manager, it is unnecessary to understand even the smallest portion of this material. The formulas which apply to telephone traffic are all well-tried and generally useful. Even the best of these formulas will only approximate the actual traffic experienced at the ACD, but some are useful for obtaining a rough estimate of the required agents and trunks at various call volumes. The essential problem of teletraffic engineering centers on the delay customers will experience when trying to use a service and their tolerance to delay before they abandon the call.

This is a problem each of us encounters when trying to choose a restaurant and guessing how long we might have to wait based on the popularity of the restaurant. The supermarket owner faces a similar problem when deciding how many checkers to put on the floor. It is uneconomical to have checkers standing idle if there are too few checkers. However, it is bad for business to have long lines of people trying to get service from too few checkers. Teletraffic engineering attempts to reduce this quandary to a mathematical relationship and make an educated guess about the duration of waiting times when varying volumes of people demand a service.

The difficulty with all of these formulas, and the unfortunate flaw in most forecasting packages, is that the formulas assume blocked calls will be held in the delay queue until answered. In an ACD environment the abandoned call rate is a critical factor.

With an ACD all callers do not hang on until their call is answered; in some cases this would mean holding the line for ten to twenty minutes. Abandoned calls significantly lower the traffic load on the ACD, lower the holding times for those who do choose to wait, and decrease the number of staff required. The standard formulas assume that callers will wait until answered. This assumption is matched when the ACD has a very short average speed of answer. If agents are answering calls quickly, no one has to wait so long that they hang up. So, unless the call-handling rate at the ACD produces an

average speed of answer below five or ten seconds, the numbers any of these formulas predict will be inaccurate by a significant margin.

All of these formulas are predicated on the number of calls offered. A closer approximation can be gained by using the number of calls handled in the various formulas. Of course, this procedure requires a close look at the abandoned call reports of the ACD and then a guess as to the abandoned call rate for whatever future period is being considered. If the number of calls abandoned is ignored, any traffic calculations based on the handled calls could completely underestimate the total amount of traffic being lost from the center. A similar situation would occur if a restaurant owner only considered the number of people waiting at the bar and ignored the throngs which peered in the window and left without being served. This approach is limited by the need to guess the handled call rate for any given rate of offered traffic.

Figure IV-1 compares some actual handled traffic for a major airline with the numbers predicted by the Erlang C traffic formula. The Erlang C formula is used as an example to demonstrate the inaccuracy of a formula which does not consider abandoned calls. The Erlang formulas are explained in more detail later in this chapter.

The modern ACD offers a wealth of data which can be substituted for the theories in many cases and produce more accurate forecasting models. Most of the forecasting at well-managed ACD centers is based on such historical data. This type of approach compares past volumes, and the staff required to handle that traffic, with the current volumes. The manager then applies a straightforward division process to predict the traffic and staffing parameters for the new load. This approach has the virtues of simplicity and accuracy, provided the variations in traffic volumes between the present and historical volumes are not substantial. Some forecasting packages use only historical data and make predictions without considering the traffic load for the reporting period actually in progress.

Such historical methods can account for long-range planning where call volumes remain constant, but in a changing environment they fail. Historical methods are particularly unrealistic in the day-to-day operation and real-time management of an ACD center, unless they take real-time conditions into account.

THEORETICAL AND OBSERVED TRAFFIC PATTERNS

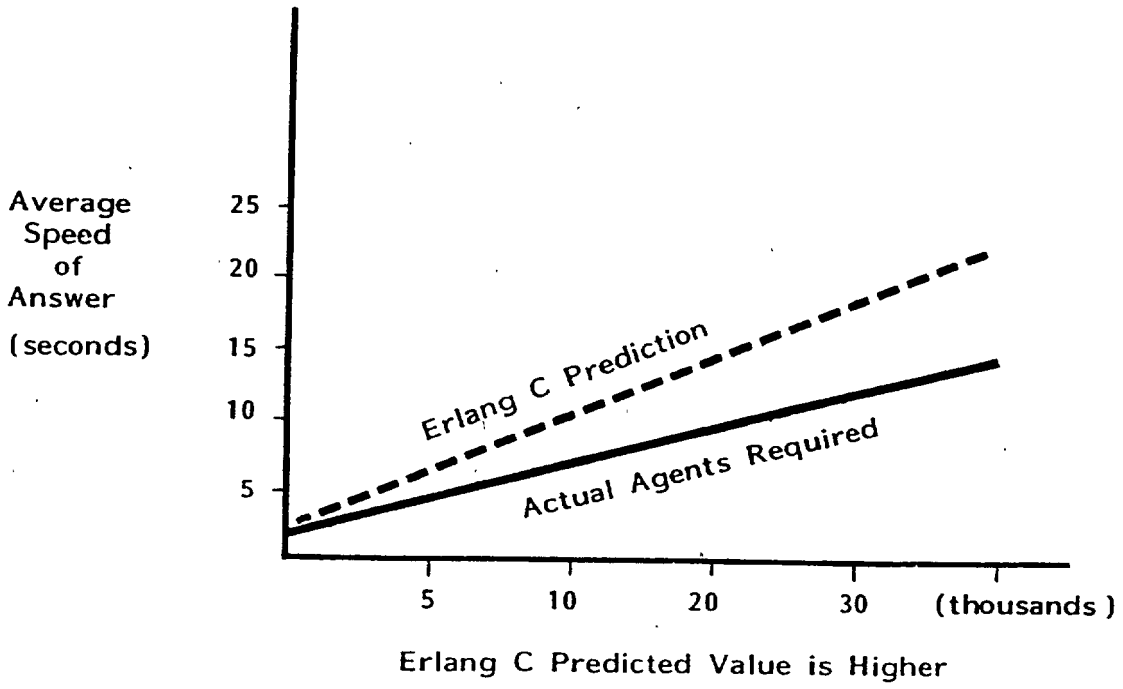


Figure IV-1

The purpose of teletraffic engineering, for the ACD manager, is to determine how long callers will have to wait for an answer given various volumes of traffic and various levels of staffing within the center. These simple formulas can then be used to determine how close the ACD will come to meeting the desired service level--given inputs on the wide variety of factors that affect the call-handling capability of any given ACD.

Traffic engineering typically considers only the busy hours or busy days when estimating the total resources needed to meet a given service level. This method is adequate in toll services and central office planning, but the ACD manager should look at the call-handling volumes in much greater detail throughout the week, the day, and the year.

Graphs of the call volumes for various periods should be prepared and analyzed until the manager is confident that any patterns have been detected which would allow fluctuations in traffic volume to be predicted and handled.

In many ACD's the revenue can approach several hundred dollars a call. It is advantageous under these circumstances, given the flexibility of a modern ACD for configuration changes, to continually monitor the traffic volume and service level and adjust accordingly.

The ACD manager should staff by the shift, by the hour, by the half-hour, or by the lowest increment of time within which changes can economically be made in the staffing. Trunking should be managed to take account of the shortest time period within which trunks can be economically added and dropped from the center--which is around one month for a WATS line and perhaps 60 days for a foreign exchange line.

In order to explain the relevant traffic formulas a few definitions are in order. The number of people available to provide a service, or answer a telephone, is known as the number of "service channels."

The length of time that the customer or caller spends being waited on, or talked to, is known as the "service time"; or, in the case of most ACD's, the "handling time." When this is used to refer to a trunk it is usually called the "holding time." Whichever term is used, it simply means the length of time that a customer is actually using a service channel.

If a customer finds that all the service channels are occupied, he may choose to wait for service, thereby entering a "queue." An ACD will typically have several queues in operation. There will be one queue for incoming trunks which will hold customers while they're waiting for service. There will be other queues which hold agents waiting for calls, hold outgoing calls, or hold requests for transfer calls within or outside the ACD.

The queue is a waiting line and is usually served on a first in first out (FIFO) basis. In the case of trunk queues there also may be priority trunks which are placed in line at the head of the queue. The customers that start waiting first will be served first, as soon as a service channel opens.

The number of calls that enter an ACD is presumed to be random. Any one of several thousand callers might pick up the phone at any instance and place a call. This random feature of telephone traffic is a key assumption in traffic engineering, but this does not mean the traffic is without a pattern altogether. While the individual call initiation is random, the overall pattern of calls received by the ACD takes on a discernible fluctuation which can be graphed through the hour, day, week, month, and year.

If a call is not able to access a service channel immediately, that call is said to be "blocked." A blocked call will either be "held" or "lost." These terms mean just what their names imply: that the caller will stay on the line and be held in the system, or the caller will refuse to wait in the queue, and as the caller abandons the effort of waiting, the call will be lost from the system.

Given these variables and their definitions, it is necessary to examine the application of these statistics. Within the ACD center the manager has the ability to shift people about and consciously manipulate the staffing to account for traffic fluctuations. As mentioned above, the basic teletraffic engineering problem for the ACD manager is determining the traffic density of offered calls to the ACD and then determining the call-handling capability of the ACD given various staffing levels.

TRAFFIC DENSITY

The first item to determine is the traffic density, or the load, on the ACD system. Traffic density at the ACD really has two separate components. There is the density at the trunks, and there is the density at the gates. These figures will be different because of the queuing structure of an ACD.

Typically the ratio of trunks to agents, as defined by the traffic engineering formulas, requires a greater number of trunks than agents in order to meet a desired grade of service. This would imply that an ACD with fifty agents should have around fifty trunks, plus the increment needed for calls delayed on occupied trunks.

There are cases where more agents than trunks will be required. This occurs when there is a very detailed record-keeping function which follows each call. When the after-hang-up work time is longer than the average call-handling time there will be fewer agents than trunks required. Otherwise, the agents will not be able to complete their paperwork before the next call arrives.

ACD's are configured with a trunk to agent ratio based on the economic nature of the incoming traffic. The higher ratios are for non-revenue service ACD's, while the lower ratios are used for revenue centers with larger dollar-per-call income. A higher trunk to agent ratio will increase the efficiency, or answering occupancy, of each individual agent. With more trunks directing calls to each agent group, the possibility that each agent will immediately have another call to answer becomes greater. There are ACD's which operate with a lot of trunks just to insure that the cost of staffing is kept to a minimum in relation to the number of calls answered. This approach provides terrible service, but it may be justifiable if the callers have nowhere else to dial.

This approach reaches its limit when the incremental cost of adding another trunk is greater than the incremental revenue derived from the increased efficiency of the agent force. Another way of finding the proper trunk to agent ratio is to consider the delay cost of the queue. A $ 12,000 a year agent costs about $.33 a minute. The manager should organize the trunk to agent ratio so as to achieve the lowest mix of costs between the delay queue and the agent's time. If the cost of the delay queue (the per minute price of both trunks and abandoned calls) exceeds the cost per minute

of placing an agent to answer those calls, it makes more sense to add the agent. The trunk to agent ratio is determined, just as the service level, by the point of marginal productivity between trunks and agents.

This trunk/agent ratio is decreased in a revenue center, not because the number of trunks is lessened, but because the number of agents is increased. As the revenue per call increases, it becomes more economical to add additional agents. Eventually the addition of agents produces a very small delay queue and the high ratio of trunks is no longer necessary.

In a situation with more traffic channels than servers (agents), the load on the two will be distinct quantities. Of course, the quantities do have a direct effect on each other. If the number of agents required and the number of trunks required are matched very closely to the actual incoming traffic volumes, then this balance can be easily upset. If a few agents take a break at the wrong time, the delay queues will immediately lengthen. If a few trunks cease working, the agents will become less efficient (that is, they will spend a smaller portion of their time actually handling calls).

The traffic which reaches the ACD will occupy its capacity at two points: on the trunks and at the agent consoles. The call-holding time, as shown in the Administrative Data System (ADS), or Management Information System (MIS) reports, indicates the length of time a call has been queued on the trunks and the length of time that the call was occupying an agent's attention.

The handling time combined with the after-hang-up work time for the agents is adequate for determining the staffing levels at the switch. However, this figure does not include the time that the call actually occupied the incoming trunk.

If there are delay recorders on the ACD, then the trunk may have been occupied for ten to thirty seconds prior to answer while the customer was given ringback or music. This period will not be figured into the switch-occupied time on the agent's reports, nor will it be billable time at the ACD itself. To obtain this figure, it is necessary to examine the trunking reports showing an average holding time or an average trunk activity summary. When developing an analysis of the traffic density, these separate areas should be kept in mind.

The number of calls offered to the ACD is essentially a random variable, as is the length of time that those callers will occupy a service channel. The rate at which calls are entering the ACD can be described by the mean frequency of the offered calls.

The mean frequency of offered calls is the average time interval between call initiations to the ACD, as outlined in Figure IV-2. The graph shows that there are an average of thirty calls entering the ACD during any given half hour out of the three half hours shown. Although the actual number of incoming calls varies from 20 to 40 calls during the half-hour period, it is the average offered call rate that is used to determine the density of traffic.

Another important measure is the average length of time a caller is using a service channel. Looking again at the graph of calls during the three half-hour periods, it can be determined that each person calling into the ACD speaks for an average of 180 seconds. Again, there is considerable variation, with some people staying on the telephone 30 seconds and some as much as 500 seconds.

In this example, the ACD is offered thirty calls, on the average, during each half hour with a holding time of 180 seconds per call. The density of traffic at the ACD is obtained by multiplying the average number of calls (during any time period) by the average holding time on the call:

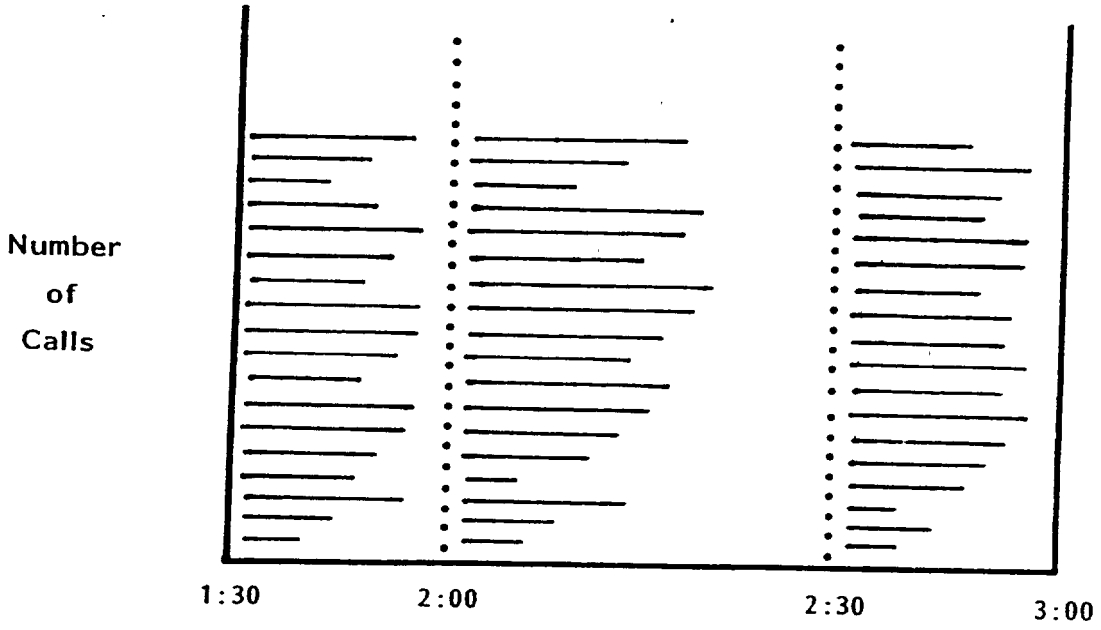
Traffic Intensity = 30 Calls X 180 Seconds

This is equal to 5400 call-seconds of traffic.

Typically this measure of traffic is expressed in two forms with telephony: Erlangs and CCS.

ERLANGS AND CCS

Erlangs are a dimensionless measure of the traffic. An erlang is not associated with any specific length of reporting period. The erlang figure is derived by dividing the number of calls by the length of time during which that traffic intensity was counted. As such, the erlang is simply the "mean" or average traffic density. It is a measure of the average amount of traffic which would be expected at any given moment in the measured period. Since, in this example, there were



Number of Calls and Length Per Half Hour

(Bar equals length of call)

Figure IV-2

30 calls within a half-hour period, the 5400 seconds of traffic intensity are divided by 1800 seconds in the half hour with the result indicatinge there were three erlangs of traffic at the ACD during this period.

CCS (100 call-seconds) is a quantity that is always determined for an hour's worth of traffic. To derive CCS's of traffic from this example, we would take 30 calls X 180 seconds of handling time. This equals, again, 5400. This 5400 seconds indicates that there were 5400 seconds of activity at the ACD during that half hour. The callers were using the ACD service (either talking to agents or waiting in queues for agents) for 5400 seconds of total occupied time. CCS is measured for an hour, so this 5400 is multiplied by two to derive the figure for the hour, which is 10,800 seconds of occupied service time during an hour at the ACD. Because this number is rather cumbersome, the practice in telephony is to report it in CCS, or hundred call-seconds, rather than CS, which would be the total call-seconds. Dividing 10,800 by 100 we see that there are 108 CCS of traffic at the ACD during an average hour-long period.

Both are useful measures. This book will concentrate on traffic measured in erlangs, but the conversion back and forth between the two measurements is straightforward. To convert CCS to erlangs, divide the CCS's of traffic by thirty-six. Erlangs are converted into CCS by multiplying the number of erlangs by thirty-six.

Since most of an ACD manager's staffing decisions are made by the half hour or in real-time, rather than the hour, this book uses Erlang formulas. This allows for a conversion into any unit of time, instead of reporting the figures and making judgements based on an hour-long period. The report packages in the ACD industry mainly use the half hour as the standard reporting period.

Erlangs give an indication of the mean or average traffic density, but this measure alone is not sufficient to effectively manage an ACD center. There must also be some awareness as to how far the values are spread around this average traffic density figure. It is quite a different situation to staff a center with an average of ten erlangs of traffic where that average swings from one call per minute to twenty calls per minute versus staffing a center that always carries ten calls during any given holding period.

A useful measure which provides some indicatioin of the average traffic density spread is called the "variance." The variance equals the average of the mean squared minus the square of the mean. The variance shows the ACD manager how widely the trffic patterns are spread.

Another useful measure which uses the variance is the "variance to mean ratio." The variance to mean ratio is found by dividing the variance by the mean. The variance to mean ratio is useful for the manager in determining the type of traffic that will be offered at the ACD. When the variance to mean is equal to one, the traffic is considered random. If the ratio is not equal to one, the traffic is considered non-random. When the ratio is less than one, the traffic is fairly even and there will be a constant traffic density at the switch. If the ratio is greater than one, the traffic will show wide swings in the load experienced at the ACD.

The "standard deviation" is another measure useful in traffic engineering. This measure is commonly used in the empirical social sciences and is defined as the "square root of the variance." The standard deviation measure is used to determine the accuracy or "confidence level" of any probability function. The standard deviation allows a manager to predict how accurate his or her predictions are likely to be. This is the same type of thing that professional pollsters do when they make their predictions--plus or minus five percent. This usually means that ninety times out of a hundred they will be within five percent of their published figures.

An example taken from an actual ACD report may assist in clarifying the meaning and application of these terms. Consider Figure IV-3, which lists the number of offered calls at the general sales gate of a major airline. This is not a typical application for this procedure. Most traffic engineering texts apply the formulas to the traffic within a one-hour period. The formulas are being applied in the manner described herein to extend their usefulness within the ACD environment.

The average value of the number of calls offered can be computed from this list by adding together the number of calls multiplied by the average handling time and dividing by the interval in the reporting field. This works out to an average of about twenty erlangs of traffic throughout the twenty-one reporting intervals.

TRAFFIC DENSITY FOR ONE DAY

Time	Calls Offered	Average Handling Time
0800	82	158
0830	137	129
0900	139	202
0930	295	157
1000	257	182
1030	336	176
1100	234	196
1130	268	168
1200	226	157
1230	188	151
1300	200	188
1330	197	181
1400	182	196
1430	194	141
1500	200	113
1530	248	152
1600	234	190
1630	210	203
1700	178	208
1730	218	148
1800	132	168

Traffic X Handling Time = Erlangs

82	X	158	= 7.1978
137	X	129	= 9.8183
139	X	202	= 15.5989
295	X	157	= 25.7306
257	X	182	= 29.9855
336	X	176	= 32.8533
234	X	196	= 25.4800
268	X	168	= 25.0133
226	X	157	= 19.7122
188	X	151	= 15.7711
200	X	188	= 20.8889
197	X	181	= 19.8094
182	X	196	= 19.8178
194	X	141	= 15.1967
200	X	113	= 12.5556
248	X	152	= 20.9422
234	X	190	= 24.7000
210	X	203	= 23.6833
178	X	208	= 20.5689
218	X	148	= 17.9244
132	X	168	= 12.3200

Total = 415.5682
Divided by 21 half-hour reporting intervals = 19.788961 Erlangs

Figure IV-3

The lower half of Figure IV-3 provides an example of this computation using the numbers from the gate report for an airline.

Each one of the individual erlang values for any half-hour period has an associated probability function. This probability equals the frequency of the observed value divided by the number of values. It is rather difficult to work with the numbers listed so the table below considers only rounded values for the distribution of erlangs.

FREQUENCY DISTRIBUTION

Freq.	1	1	1	1	1	2	1	3	3	1	3	1	1	1	
Value	7	10	12	13	15	16	18	20	21	24	25	26	30	33	

Figure IV-4

The probability that there will be twenty calls in progress is computed by dividing the frequency of that value by the total number of possible values. Since there are twenty-one different reporting intervals, there could have been twenty-one different values observed. However, twenty erlangs actually appeared in only three of those intervals. This equals a probability function of three divided by twenty-one or P = .1428.

Such a figure implies that the value of twenty erlangs would be expected to appear about fourteen percent of the time during the average day. This assumes an average day had the same distribution of incoming calls. Since, in the example provided, twenty is also the mean or average erlang number anticipated for this distribution, the manager can expect the ACD to experience that average load about fourteen percent of the time during the day. This average figure does not say enough without also considering the distribution of the traffic around this average figure.

The variance, the variance to mean ratio, and the standard deviation, are used to provide this additional information. Consider Figure IV-5 which lists the same erlang values as the previous table, but with the probability function rather than the observed frequency of occurrence.

Using these rounded numbers, the mean equals the sum of the values multiplied by their probability function, which is 19.9034 erlangs of traffic on the average. The variance is described as the value squared times the probability of that value minus the square of the mean:

$(7^2 \times .0476 + 10^2 \times .0476 \times \ldots$
$33^2 \times .0476) - 19.9034^2$ or $436.2578 - 396.1453$

equals a variance of 40.1125.

This implies considerable distribution of the values about the mean, as is obvious from the first chart. Here the variance to mean ratio is the variance divided by the mean or 40.1125/19.9034 or 2.01. From these relatively simple calculations the ACD manager can derive an accurate picture of his traffic flow and begin to staff the center in a scientific manner.

A very large variance implies that money will be lost unless there are wide variations in the number of agents staffed during any half-hour period. A variance to mean ratio less than one indicates that the traffic is smooth and the manager can take less account of variable staffing.

Each of these measures can prove useful if they are used in a variety of experiments to improve the manager's understanding of the traffic characteristics of an individual ACD. The standard deviation, which allows a prediction of the confidence level of various distribution measures, will not be discussed in detail. The books listed in the Bibliography provide the in-depth treatment necessary to fully understand this topic.

PROBABILITY FUNCTIONS

Prob.	.0476	.0476	.0476	.0476	.0476	.0952	.0476	.1429
Value	7	10	12	13	15	16	18	20

Prob.	.1429	.0476	.1429	.0476	.0476	.0476
Value	21	24	25	26	30	33

Figure IV-5

In addition to the intuitive, hand-calculated approach to understanding traffic flows, there are several different formulas used in the analysis of

telephone traffic. For the ACD manager, the two of primary interest are the Erlang B and the Erlang C calculations. There are a number of variations on this theme, most notably the work by Jewett and Schrago on the Extended Erlang tables and the Fast Retrial tables. Their work is highly recommended to any student of this area.

To find the number of trunks required for any given service level, Erlang B is used. In a telephone system that provides waiting queues for delayed callers, the Erlang C formula is used to find the traffic load and the number of servers needed to work off the traffic. In the ACD environment, Erlang C is the primary formula to be used because calls will be held, or queued, on the trunks, as well as inside the ACD while waiting for an agent. Staffing calculations should be based on this.

It should be remembered that these formulas do not account for the abandoned call rate within the queue. The total number of trunks into the ACD from the central office should still be done on the basis of the Erlang B formula (which determines the amount of traffic and trunks required for a telephone service without queuing), since calls that are blocked at the central office will not be held in a delay queue. They will receive a busy tone and be lost from the system until the caller makes a retrial effort.

The Erlang C formula is applicable to multiple server conditions with infinite queue lengths, infinite waiting periods once in the queue, and exponential service times. This formula really does not apply to the ACD where the holding time is expected to flatten out, and where the queue length is expected to reach a known value rather than continually asymptotically.

There are a number of formulas, some which have been explained here, which more closely approximate the conditions in an ACD. There are also computer simulation programs which allow a computer to accurately model traffic conditions within the system.

An introductiion to these topics is included here, though the Bibliography suggests sources for more in-depth research; the importance of continued study cannot be stressed enough. The ACD itself is probably the best source of information. By a careful analysis of the system reports, an accurate estimation of trunking and staffing sometimes can be determined without the use of special formulas.

The critical factors in the use of traffic formulas are the rate at which incoming calls arrive at the ACD and the average length of time those calls will be connected to the ACD. This includes the time spent holding the trunk and the time spent talking with the agent. As discussed above, these two figures provide a measure of the load on the system. For example, imagine there are two calls arriving at the ACD every twenty seconds and that the average handling time for each call is 180 seconds.

The traffic intensity, expressed in erlangs, will be: 1800 seconds in the half-hour reporting period, divided by 20 seconds, and then multiplied by the 2 calls during every 20-second period = 180 calls. This is multiplied by the number of seconds in the average handling period: 180 calls X 180 seconds of handling time = 32,400 call-seconds. The number of call-seconds is then divided by 1800 seconds, the length of the reporting period, to find the number of erlangs of traffic:

32,400/1800 seconds = 18 erlangs of traffic.

Judging from the method by which this number was constructed, it is clear that an erlang simply expresses the average number of calls one could expect in any given holding period. Two calls every twenty seconds is eighteen calls in 180 seconds. Eighteen calls in every given 180-second period is exactly what eighteen erlangs implies.

The convenient thing about this is that it conveys a great deal of information in a single number. The erlang, as a unit of traffic measurement, implies three things about the traffic at the ACD for a traffic intensity of "X" erlangs:

1. That there will be an average of X calls in progress simultaneously at any given time within the ACD.

2. That during the interval of the average handling time there will be X calls originated.

3. That it will require X hours of agent time to work off that volume of traffic.

This measure can also be used in a number of convenient formulas for determining the traffic-handling

capacity and staffing requirements of the ACD center. Most of these formulas have been worked through and tabulated to allow the use of a table instead of a computer or calculator to predict traffic measures. The chapter on forecasting in this book includes some simple routines, written in BASIC, for traffic engineering. Those works on traffic engineering listed in the Bibliography also provide tables used for the various predictions.

With this understanding of traffic intensity, the items of primary interest for the ACD manager include the probability that there will be blocking based on various levels of staffing and the delay customers will experience given different service levels.

Using an example with three erlangs of traffic at the ACD, the following table of delay probabilities, printed in Figure IV-6, can be used to determine the probability of blocking for different staffing levels. This portion of an Erlang C table has already been computed for various levels of blocking.

Running down the left column under the "Erlangs" heading, find the row which runs across from 3.00 erlangs of traffic. The row across the top of the table shows the blocking probability given any number of agents from two to eight. Following across the row from 3.00 erlangs, it is clear that if three agents are used to answer three erlangs of traffic, the probability that there will be blockage on the ACD is 100 percent. Every call that arrives at the ACD will experience some delay before being answered by an agent. If four agents were working, then the delay probability would be percentage corresponds in a rough fashion to the service level of the ACD. With seven agents the probability of blockage is .0377, with around 4 percent of all calls experiencing some delay.

This is intriguing, but not very useful. Most ACD managers are concerned with more than answering all of their calls within some time limit. They are concerned with answering, for instance, 80 % of their calls in twenty seconds or less. This table only shows the probability that some calls will have to wait in queue because they will not be immediately answered. The additional factors can be calculated using the formulas for delay listed at the end of this chapter.

The average delay on all calls equals:

Probability of Delay times
(Average Handling Time /
of Agents - Erlangs of Traffic)

The delay on delayed calls uses the same formula, but does not multiply by the probability of delay. These two formulas are equivalent to the average speed of answer for the former and the average delay in queue, for the latter.

The Erlang C tables assume that each caller entering the ACD will remain in line until the call is answered. One major advantage to owning an ACD is that the queuing will smooth the traffic flow, hold some callers a reasonable period of time, and allow the ACD to answer a greater number of callers with a smaller number of agents.

By using a greater number of trunks than agents, and packing the calls into the delay queues, the effective occupancy (defined as the percentage of assigned time spent handling calls) of the agents can be raised considerably. This accounts in part for the increased call-handling efficiencies that users experience when they move from an ordinary call-answering center to one controlled by an ACD. The Erlang C formula and delay tables are the most common theoretical measurements for systems which hold callers in a delay queue until answered.

ERLANG C DELAY TABLE

ERLANGS AGENTS = 2	3	4	5	6	7	8
2.75	.8467	.4095	.1788	.0702	.0248	.0079	.0079
3.00	1.000	.5094	.2362	.0991	.0377	.0130
3.25		.6191	.3026	.1348	.0546	.0201

Figure IV-6

Another important formula for the ACD manager is the Erlang B calculation, listed at the end of this chapter.

The Erlang B calculation provides a theoretical probability that a given traffic intensity will be prevented from using a service channel if there are only a given number of channels assigned.

The Erlang B formula assumes that anyone encountering a busy service channel will be lost from the system, hang up, and allow that service channel to be used by the next caller. Again, the Jewett and Schrago Fast Retrial tables can be used to account for people who immediately redial a lost call.

In the previous formula (Erlang C) the callers were held in queue until answered. The Erlang B formula, and the tables computed from this formula, are useful in determining the number of trunks needed at the ACD. This formula provides a theoretical measure of the blocking or percent of all trunks that will be busy. The service level for trunks assigned at the central office is typically estimated from this formula, or from similar measures.

Of course the electronic ACD will provide the manager with reported values that are much more accurate than the Erlang B or Erlang C formulas, but these are useful tools in forecasting and for initially installing an ACD. They can also be used to determine if the trunks are operating properly. Some ACD's do not provide a direct summary of malfunctioning trunks. However, if the traffic entering the center is out of line with the capacity of the trunks or the expected delay values, this can be a useful starting point for further investigation.

The following example should assist in understanding the application of Erlang B. Assume that ten erlangs of traffic are offered to a group of fifteen trunks. The Erlang B formula can be used to predict the probability that traffic will be lost in this situation, or a computed erlang table can be used.

Consider the portion of an Erlang B table in Figure IV-7 below. Reading across the table for ten erlangs and looking under fifteen trunks, the probability of losing traffic under these conditions is .0365. Almost four percent of the traffic will be lost under these conditions. To find the total lost traffic, the probability of loss is multiplied by the offered traffic. In this case the lost traffic is equal to.365 erlangs. Similarly, if the manager wishes to discover how many

trunks must be added to achieve a probability of loss equal to ten percent for fifteen trunks, the table should be scanned over to .10 and the number of trunks required is shown as thirteen.

ERLANG B TABLE

	Service Channels						
Erlangs	12	13	14	15	16	17	18
10.00 |	.1632	.1197	.0843	.0568	.0365	.0223	.0130

Figure IV-7

The Erlang B formula, or the tables, can also be used to determine the amount of traffic which will be carried on a series of trunks connected in a rotary. The assumption is made that whatever traffic is lost from the first trunk in a group, as predicted by the erlang loss probability, will overflow to the next trunk. This next trunk will carry an additional portion of the total offered traffic and pass the lost increment on to the next trunk. This procedure continues until there are no more trunks or until all the traffic is carried. The ACD manager can use this procedure to determine how many trunks will be needed to hold all of the customers waiting for an agent to become available. This procedure is fairly straightforward.

Consider a group of five trunks that is offered ten erlangs of traffic. The Erlang B table in Figure IV-8 shows the following values for the loss probability on each of these five trunks.

ERLANG B LOSS PROBABILITY

	Service Channels						
Erlangs	1	2	3	4	5	6	7
10.00 |	.9091	.8197	.7321	.6467	.5640	.4845	.4090

Figure IV-8

The first trunk would lose .9091 percent of the traffic offered under these conditions. The first trunk would lose .9091 X 10 erlangs or 9.091 erlangs of traffic. The second trunk would lose .8197 percent of the traffic offered in a group with two service

channels. The second trunk could lose .8197 X 10 erlangs or 8.197 erlangs. The amount of traffic each trunk carries is determined by subtracting the lost traffic from the offered traffic for each trunk. The first trunk would carry ten erlangs minus the 9.0910 erlangs of lost traffic or .909 erlangs. The second trunk would lose 8.197 erlangs of traffic, but it would carry 9.0910 erlangs of offered traffic minus 8.197 or .894 erlangs of traffic. This exercise can be repeated for all of the trunks in the group and the offered, carried, and lost traffic predicted. The traffic lost from the final group is then either lost completely or overflowed to another group. Managers in an ACD environment can use these formulas to their advantage when predicting the number of WATS trunks needed for any particular grade of service.

The efficiency of a trunking or staffing arrangement is an important consideration for the ACD manager. Efficiency is a measure which indicates the percentage of time a service channel is actually carrying traffic. The maximum efficiency of a single channel would be 100 percent. However, no one should attempt to reach this efficiency level because there is a trade-off between efficiency and the probability of blockage on a trunk. To reach this 100 percent efficiency level would require that there be 100 percent blockage on the service channel. Some customers would always have to be backed up waiting for service. Efficiency is a good indication of the utilization of the service channels, but a poor measure of the quality of service presented to the customers. Efficiency and the probability of blockage must be considered together to get a realistic estimate of the call-handling performance of the ACD center.

Look at the efficiency of a group of twenty trunks which are clearing blocked calls with a blocking probability of .05. The formula for determining this is as follows:

$$\text{Efficiency} = \frac{\text{Erlangs}}{\text{\# of Trunks}} (1 - \text{Blocking Probability})$$

The table of erlang values shows that twenty trunks with a blocking probability of two percent (.02) can carry a maximum of 13.0 erlangs of traffic. The efficiency of this trunk group is then 63.7 percent. This calculation can be repeated for a range of trunk sizes and plotted to determine the efficiency of larger or smaller trunk groups. Such an exercise will show that larger trunk groups carry traffic more efficiently than do the smaller groups. The blocking probability can be held constant while the size of the group is

increased to improve the efficiency level of the trunk group. There is a limit to this exercise. Unfortunately, the efficiency of large groups only holds if they are engineered to avoid overload conditions. If, in a trunk group with twenty lines engineered for a blocking probability of .02, an overload condition of twenty percent is applied, the blocking probability for those twenty trunks rises dramatically to .0534. The blocking probability increases by over two and one half when the traffic intensity is increased by twenty percent.

The same condition will be observed in a group of agents. There are many ACD's which are operating near peak efficiency; the agents are handling calls without any slack time between calls. This situation can lead to massive overloads if a burst of calls hits an ACD which is so finely tuned that the agents are always busy. Such an overload condition will be alleviated slightly by the increasing rate at which customers drop out of the delay queue as the wait gets significantly longer.

The manager must be careful to engineer the trunks and staffing of the ACD center in order to obtain the highest efficiency within the defined service level--while at the same time keeping in mind the effect that bursts of overload traffic will have on any given configuration. A group of curves should be outlined that show the average and maximum traffic. The trunking and staffing configurations can then be plotted against these curves to insure that the trade-offs between efficiency and service level do not result in overloads on the switch. The ACD will also allow the use of overflow groups within the switch to handle excessive traffic inflows. The use of secondary agent groups, and overflow/diversion tie lines between multi-node ACD's, can provide for larger simulated traffic-carrying groups and greatly increase the efficiencies of the agent force.

The delay times in the system are considered in two ways. These times may be calculated for all the calls that are handled, or calculated only on those calls that are delayed. The calculation should be done both ways to get a more accurate view of the service level.

The delay calculated on all calls averages in those calls which experience zero delay and so presents a more optimistic view of the call-handling rate. The delay time calculated for only the delayed calls ignores the calls that were answered immediately, and provides some idea as to how long the hapless people in the queue waited for your agents to rescue them. There

Probability of Queue Length Exceeding A Specified Value

$= (a/c)^{q_x}$ Prob of Delay

Binomial distribution indicates the total number of lines that will be busy at a given time.

Probability of z busy lines out of the total number of lines $= \frac{s!}{x!(s-x)!}$ x probability of one line busy^z(1 - prob)total lines minus z

where: h = probability of one line busy
x = variable number of lines that may be busy
s = total lines

then: $B'(x,s,h) = \frac{s!}{x!(s-x)!} h^x(1-h)^{s-x}$

For the binomial distribution:

Mean = sh
Variance = sh(1-h)
VMR = (1-h) or v/m

CHAPTER FOURTEEN

BASIC ACD ECONOMIC ANALYSIS

The ACD manager may or may not be directly involved in the final budgeting decisions. In almost all cases the manager will have a peripheral hand in this activity and should possess at least a basic understanding of the budgeting process and the fundamentals of economic analysis which determine the worth of a capital expenditure.

Capital expenditures, in particular investments for replacement equipment or modifications to existing facilities, will require the top communications manager's involvement. The ACD manager will continually be faced with decisions about expanding the present ACD or buying a replacement machine, hiring agents or adding trunks, increasing or decreasing the service level. For this reason each manager must be capable of determining the worth of any investment, or at least be able to direct the finance department in the production of investment analyses.

Capital expenditures are used to procure the assets of the ACD center which are applied to the production of revenue. The budget is a plan which shows the flow of money into and from the center over some period of time. The ACD is normally expected to provide revenue or a revenue assistance service for a ten-year period (with occasional software enhancements to the basic architecture). For this reason it is necessary to complete the ten-year capital expenditure planning and determine the cash flow for the life of the equipment. Since the ACD is a fairly long-lived asset, it is necessary to consider discounting, over its life cycle, the effects of inflation and the lost opportunity costs.

There are five general steps that apply to any analysis of a capital expenditure. First, the expected cash flows are estimated, including the estimated salvage value of the asset at the end of its life cycle. Next, the riskiness of these projected cash flows is estimated. An appropriate discount rate, called the cost of capital, is chosen. The expected cash flows are discounted through the present value method. This calculated value is compared to the cost

can be an enormous variation between the actual delay on all calls (better known as the average speed of answer), and the average delay on all the delayed calls.

There are several values describing the activity of an ACD system with delay-call queuing that are useful:

1. The probability that a caller will have to wait.

2. The probability of a caller waiting longer than a specific time period.

3. The probability that all the service channels and queue slots will be busy.

4. The average delay on all calls.

5. The probability of a queue length equal or exceeding some value.

6. The average queue length.

These relevant formulas are listed below.

The assumption of random call arrival from an infinite number of originating sources is made in this section so that the more common formulas may be applied. The service time in an ACD is more constant than exponential because the calls to ACD agents tend to group around known holding times. However, the exponential assumption is used because this is simpler to manipulate mathematically.

The administrative reports of the electronic ACD have eliminated the need for much of the tedious work involved in traffic engineering, but these skills are still necessary for forecasting against future volumes and for mathematical experiments with different system configurations. For these reasons the manager should not be content with this brief introduction. The ACD provides an excellent source of material for testing various formulas against observed data. Experimentation with these formulas should result in greater comprehension of, and appreciation for, the complexities of traffic characteristics of the ACD.

APPLICABLE FORMULAS

In these formulas:

c = the number of agents or trunks (service channels)
h = the average holding time
a = the traffic in erlangs.

Probability of Delay

$$P(/0) = \frac{\frac{a^c}{c!}\frac{c}{c-a}}{1 + a + \frac{a2}{2!} + \ldots + \frac{ac}{c!}\frac{c}{c-a}}$$

This can be found more readily by scanning through the Erlang C table and locating the probability of delay underneath the appropriate traffic density and the number of agents.

Probability of Loss

$$P = \frac{\frac{ac}{c!}}{1 + a + \frac{a2}{2!} + \ldots + \frac{ac}{c!}\frac{c}{c-a}}$$

Probability of Delay in Excess of a Specified Time Interval

$$P(/t) = (\text{Prob. of Delay})e^{-(c-a)t/h}$$

Probability of Loss in a Loss-Delay System

$$\text{Loss} = \frac{a^q}{\frac{1}{B} + \frac{a(1-a^q)}{1-a}}$$

where q is the length of the queue and B is the Erlang B formula

Average Delay on All Calls

$$\text{Avg Delay} = \text{Prob of Delay} * \frac{h}{c - a}$$

Average Delay on Delayed Calls

$$\text{Delayed Delay} = \frac{h}{c - a}$$

Average Length of the Queue

$$= \text{Prob of Delay} * \frac{a}{c - a}$$

of the project. If the asset's present value exceeds its cost, and the value of similar projects, the project is accepted. Finally, the effect of the capital budgeting process on the firm's value is considered. If the present value of the sum of the firm's projects is positive, the company will increase in value. The worth of an ACD should be compared to the overall worth of the firm. An estimate should be prepared of the additional revenue which will be generated by other departments because of the ACD. This will help accurately determine the total value of an improved communications center.

The first step, estimating the cash flow from an ACD equipment expenditure or replacement project, involves a fairly complex analysis. There are a great many intuitive factors that cannot be accounted for directly and will have to be weighed according to the manager's intelligent guesswork.

Income statements should be prepared showing the expected cash flow during each year of the equipment's projected life. The revenue generated from this equipment, as computed for the projected traffic volumes over the ten-year cycle, and the direct costs of operating the equipment are subtracted. Depreciation, if the equipment is purchased, should then be added back into the bottom line.

The cash flow estimates are prone to error. The manager should be particularly careful in this area because any mistakes will be magnified throughout the planning process. The simplest type of comparison is to take an estimated set of revenue figures then play these figures against the operating costs and capital equipment costs of a variety of ACD's. This procedure is used to determine which vendor's equipment would be the "best buy." The difficulty with this is that the features and optional capabilities of the different ACD's are difficult to compare in terms of the revenue they might generate or the operating expenses they might save.

An analysis of different ACD's would have to include such things as trunk savings for a multi-node versus a single-node system, intelligent interflow balancing versus a straight queue dump, and multi-choice queuing routines versus a fixed choice FIFO routine. The actual expenses and revenues from these items are not immediately obvious. Some effort will have to be made to include such considerations. A machine with an attractive cash flow which cannot perform all the funtions eventually demanded of it is no bargain. In almost all cases, there will be some

equivalent communications service available on the premises from the telephone company. The costs and revenues from this equipment can be used as a base line for considering the acquisition of other ACD equipment.

Once the cash flow has been estimated, it is necessary to consider an analysis of the fairly straightforward risks involved in the purchase of an ACD:

1. The equipment may not work.
2. Revenue may dip from a loss of business due to other factors.

There is not too much the ACD manager can do about the second factor. As for the first, there are both horror and success stories. The alert manager will spend enough time at trade shows and vendor installations to know who's marketing hot air and which vendor will dispatch a serviceman rather than a service manual and a left-handed screwdriver.

There is some risk analysis necessary with an ACD that is being built to meet future traffic volumes. The airlines are typically sophis- ticated enough to order their equipment two or three years in advance --based on their projected bookings. The really innovative airline communications manager works closely with the suppliers and takes considerable risks on new development projects. The payback from such developments can greatly outweigh the financial risks. In most cases the traffic volumes can be estimated at a six-month or yearly interval and--assuming there is adequate floor space for expansion--the ACD equipment can be delivered without much problem.

All of the ACD's on the market are modular and allow for expansion in an economical fashion, to within their advertised line sizes, but no greater. So long as the manager insures enough excess capacity to account for an average eight-month traffic volume growth there should be little difficulty with additional risk analysis. One problem, which involves a different type of risk, and which everyone wishes they had, is a major concern at PEOPLE. Their growth rate is so fast that keeping adequate equipment on order requires constant attention to the corporation's expansion.

Once the cash flow and risk analysis is complete, the actual cost of the money required to purchase and operate the ACD should be considered. Typically the finance department will present the ACD manager with this figure and there is no need to be completely

familiar with the procedure. The important point to understand is that each project can be given an average cost of capital which accurately reflects conditions within that project's life cycle. There is no need to accept a figure dictated by the corporation's financial officers for all projects if the ACD risk is minimal, or if there will be considerable fluctuations in the cost of capital during the project's duration. In brief, the cost of capital is the cost incurred by a firm to raise funds during the project period. The cost of capital for a corporation is an average of the cost of debt and the cost of stock, weighed by the ratio of debt to equity.

The average cost of capital, through the life cycle of the ACD equipment, is used to develop the actual cost of the capital expenditure. Based on the risk analysis, this average cost of capital should be raised, lowered, or left at the average rate. In the case of capital expenditures for an ACD, a low risk average cost of capital should be used as there is little chance of losing money on the investment. If the average cost of capital over the ten-year life cycle is fourteen percent, the ACD expenditure should be analyzed at a rate around eleven or thirteen percent to account for the low risk.

Generally, the communications manager will not be involved in any analysis of the cost of capital and this number can be obtained from the financial department. The cost of capital is a shortened form for two related concepts. The cost of capital is used to refer either to the return on investment required to maintain a firm's market value, or the return on the investment rate which the firm can realize through other capital expenditures. The latter is sometimes called the "opportunity cost" of an investment. If a firm can gain a twenty-five percent return on its investment capital by purchasing additional airplanes, it will not put money into an ACD (even assuming a positive present value rate). Because the cost of capital is eighteen percent, the borrowed money will probably be invested elsewhere for a higher return. An ACD purchasing decision must compete with other investment opportunities at the full capital cost or required return rate. Leasing ACD equipment can often be accomplished at lower interest rates than the firm could obtain by borrowing the money for a cash purchase. The leverage of larger firms may result in savings through this type of purchase agreement.

The average cost of capital can then be used in the financial evaluation of the project through a Payback Period analysis or a Net Present Value analysis. The

cash outflow and inflow from a business will occur over different periods and in varying amounts. This increases the difficulty of analyzing the worth of several competing investment opportunities. One ACD vendor may offer equipment immediately. Another vendor may require twelve months before installation. Ordering the first vendor's ACD means an immediate retirement of the inefficient equipment, but the second ACD may offer greater efficiency once installed. Deciding which is the most attractive investment is not always obvious. However, the Net Present Value methods and the cash flow analysis can account for the variable investment costs and opportunities.

Most corporations require a minimum Payback Period as well as a positive Net Present Value figure. These two forms of financial analysis are the accepted methods in modern finance.

The Payback Period indicates the number of years within which the original investment will be paid back by the revenue or savings generated by the initial expenditure. Net Present Value is the present value of the expected future returns on the investment. Net Present Value takes into account the cost of capital over the life of the project.

Initial Investment in Both ACD A & ACD B = $1,000,000
Net Cash Flow (In Thousands)
= Profit After Taxes Plus Depreciation

Year	ACD A	ACD B
1	$400	$100
2	280	200
3	260	300
4	90	400

In the example above, the expenditure on ACD A is paid back in less than four years. The expenditure on ACD B takes longer to pay off, but it is increasing in revenue value over its life cycle. The Payback Period method only analyzes the length of time required for payback. It does not consider what happens to the profitability of the equipment beyond this period.

Some of the flaws in the Payback Period method are corrected by applying the Net Present Value analysis. Most modern business calculators have Net Present Value keys and calculation is easy.

The formula for Net Present Value is:

$$NPV = \frac{R^1}{(1+k)^1} + \frac{R^2}{(1+k)^2} + \ldots + \frac{R^n}{(1+k)^n} - C$$

Where: R represents the net cash flow per year
k is the cost of capital
C is the initial cost of the ACD expenditure
n is the project's expected life cycle

The project's cash flow is the "amount by which the project's incremental effect on revenues exceeds the project's incremental effect on costs." As this formula indicates, there is no need to refer to Net Present Value tables to find the present value factor. The denominator of the equation $(1+k)^1 \ldots (1+k)^n$ allows the present value factor to be calculated for any number of years at any given cost of capital (k). This denominator is then divided into "one" to obtain the discounted cost of capital--the present value factor.

For example, if the cost of capital is twenty percent, then the present value factor for the tenth year would be $(1+k)^n$ or $(1+.20)^{10}$ which is $(1.20)^{10}$ or 6.1917. Dividing this into one gives 1/6.1917 or .1615. This means that a dollar, at twenty percent inflation, is worth about sixteen cents at the end of ten years. Tables are available in any finance textbook if needed. The formula listed is useful if a Net Present Value computation is programmed into a hand calculator or desk-top computer.

This formula discounts the net cash flow of the ACD investment against the cost of the investment capital and subtracts the initial cost of the project. This method provides an indication as to whether the project has a positive or negative Net Present Value. Only those projects with a positive present value should be undertaken. Comparing two projects, the one with the higher Net Present Value should be pursued.

Another method of discounting cash flows to analyze investment decisions is the Internal Rate of Return, or Time Adjusted Return, method. The Internal Rate of Return is very similar to Net Present Value. The Internal Rate of Return is the discount rate which would have to be factored in to reach a Net Present Value of zero. Internal Rate of Return determines what the cost of capital must be to find the equilibrium point for an investment. If the discount rate found through Internal Rate of Return is greater than the

percentage factor the firm requires to justify an investment, then the project should be undertaken. Any project which shows an Internal Rate of Return greater than zero is considered a good investment, but most companies require some increment above this to allow for contingencies. Internal Rate of Return analyses can be done by trial and error or predicted by a business analyst's hand calculator.

An example of the Net Present Value analysis is outlined below in Figure IV-9. In this example the manager is choosing a purchased ACD over a ten-year period.

NET PRESENT VALUE
(IN DOLLARS)

YEAR	SIGNIFICANT EVENTS	CASH FLOW (In 100 Thousands)			PRESENT VALUE 25% Rate	
		EXPENSES	REVENUE	NET	FACTOR	PV OF CASH FLOW
0	Purchase	900	300	(600)	1.000	(600)
1		150	350	200	.800	160
2		100	350	200	.640	128
3		100	350	200	.512	102.4
4		100	350	200	.410	82
5		150	450	200	.328	98.4
6	Expansion	750	450	(300)	.262	(78.6)
7		200	450	250	.210	52.5
8		250	450	250	.168	42
9		100	500	400	.134	53.6
10		100	550	450	.107	48.15
	Totals	1800	4550	2750		
				Net Present Value		88.45

Figure IV-9

RESOURCE ALLOCATION & COST MINIMIZATION

All of the procedures discussed above can be extremely helpful when making investment decisions. Additional methods of economic analysis quite useful in the ACD environment are concerned with resource allocation and cost minimization.

A typical resource allocation problem involves decisions about whether or not to add an additional agent, an additional console, or an additional feature. In these examples the manager is faced with analyzing a single input with constant marginal

product. Constant marginal product implies that for each additional unit added to the ACD there will be a corresponding increase in output at the ACD.

This increase in productivity will be equal for each input (or agent, etc.). If the addition of one agent results in an increase of revenues by one-tenth percent, then the addition of five agents would result in a revenue increase of five-tenths percent--under the assumptions of constant marginal product.

Given this type of relationship the manager would add additional agents until some limit is reached, such as the total operating budget, the offered traffic ceiling, or the ACD's expansion capacity. The equivalent value of adding each agent is computed by multiplying the agent's marginal revenue by the increased productivity. If each call is worth one hundred dollars, then adding five agents would produce an additional five hundred dollars times the number of additional calls handled during the working period. The total revenue produced would be the marginal revenue product minus the cost of the agents. If an agent (and the associated overhead and equipment) costs less than the additional revenue production, the manager should obviously add as many agents as possible.

There are some additional twists to this type of analysis. Even though the addition of each agent produces an increment of revenue gain for the center, there can be other factors which make hiring uneconomical.

For example, adding twenty agents may cost little in terms of floor space, trunks, termination cards, and additional supervisory overhead. Adding an additional ten after that may require knocking out a wall, hiring another supervisor, and putting another termination cabinet on the ACD. The costs associated with additional inputs, even under the assumption of constant marginal product, must be factored into any resource allocation decision.

Another variation is that there will often be several competing uses for any given input. Additional agents could be placed in either the credit services gate or the customer applications gate. Suppose that agents in the credit services gate produce revenue of ten dollars per call, while agents in customer allocations product five dollars per call. The tendency is to increase the number of agents in credit services as quickly as possible. However, there is a limit to the number of calls which need to be handled

in credit services. The agents would be assigned to credit services until that limit was reached, then the application gate would be staffed.

In most cases the ACD manager will not be operating under the assumptions of constant marginal product. Each agent does not add a constant amount to the production of the call center revenue. The ACD operates under the assumption of decreasing marginal revenue. In this case each additional productive unit will, up to some point, increase revenue, but the additional units will increase revenue by a smaller and smaller amount. This would be the case where the ACD was approaching some maximum capacity for offered traffic and the additional agents or trunks would not significantly improve the handled traffic rate. However, given the vagaries of telephone traffic, there will also be cases of increasing marginal product. For instance, the addition of agents to an understaffed group, or the creation of a more efficient large group out of several small ones, will result in a greater amount of traffic being handled per agent and an increase in the marginal product.

There are analytical solutions to resource allocation problems which can be found in the works listed in the Bibliography. These solutions may be quite complex and very powerful. A study of the methods suggested in Managerial Economics, Henry and Haynes, is well worth the effort. However, for the purposes of this book, a simpler solution that yields essentially the same results--by means of a more cumbersome procedure--will be discussed.

INCREMENTAL REASONING

For a resource allocation problem which involves the maximization of revenue at the ACD gates, the process of incremental reasoning can be applied. This method considers the increase of revenue for each additional agent in the gate and determines whether the cost of adding that agent was greater than the increment of returned revenue. When a point is reached where the additional revenue is less than the cost of the input required to achieve that additional revenue, the manager knows that the maximum revenue-production point has been attained.

Figure IV-10 displays the work sheet for such a problem. The number of calls answered was derived theoretically by assuming that 1600 calls per day, at a ten erlang per half-hour rate, would be offered to the gate. This was multiplied by the Erlang B probability

REVENUE MAXIMIZATION

Calls Handld	# Of Agents	Labor Cost	Trunk Cost	Gross Revenue	Net Revenue	Icr Rtn	Er B	Er C
145.44	1	$160	$1200	$1454	$ 94	$ 94	.9091	
288.48	2	320	1200	2884	1364	1270	.8197	
428.64	3	480	1200	4286	2606	1242	.7321	
565.28	4	640	1200	5652	3812	1206	.6467	
697.60	5	800	1200	6976	4976	1164	.5640	
824.80	6	960	1200	8248	6080	1112	.4845	
945.60	7	1120	1200	9456	7136	1056	.4080	
1058.72	8	1280	1200	10587	8107	971	.3383	
1162.64	9	1440	1200	11626	8986	879	.2732	
1256.64	10	1600	1200	12566	9766	780	.2146	1.00
1338.88	11	1760	1200	13388	10428	662	.1632	.6821
1408.88	12	1920	1200	14088	10968	540	.1197	.4494
1465.12	13	2080	1200	14651	11371	403	.0843	.2853
1509.12	14	2240	1200	15091	11651	280	.0568	.1741
1541.60	15	2400	1200	15416	11816	165	.0365	.1020
1564.32	16	2560	1200	15643	11883	67*	.0223	
1579.20	17	2720	1200	15792			.0130	
1588.64	18	2880	1200	15886			.0071	
1593.92	19	3040	1200	15939			.0038	
1596.96	20	3200	1200	15969			.0019	

This simulation assumes 1600 calls offered per eight-hour working day with an average handling time of 180 seconds. The trunk costs are fixed at 1200 dollars per day.

*Break Point for Agent Additions

Figure IV-10

figure to derive an answered calls number. In practical applications the numbers found in the ACD reports should be used. The number of agents varies from one to twenty. The labor costs for agents is set at twenty dollars an hour to include salary, equipment, and administrative overhead. The trunk costs were assumed to be $26,400 per month, or $1200 per day, for a maximum of twenty trunks.

This simulation could be calculated using variable trunk costs, but the maximum expected value is simpler to work with and provides the increased agent efficiencies at the low end, which may benefit some ACD centers. The gross revenue is figured by assuming each call averages ten dollars in revenue. Of course some calls will be more, some produce no revenue, but the average for this center is ten dollars. The net revenue is simply the gross minus the expenses for trunks and agents. The next field, labeled "Icr Rtn," is the "incremental return" for each additional agent. This is net revenue minus the previous net revenue.

This field shows the amount of additional revenue produced by each additional agent. Once the fifteenth agent is added, the maximum revenue has been obtained. Adding the sixteenth agent lowers the incremental revenue below the $160 cost of an additional agent. At this point it becomes uneconomical to load the system any more.

The Erlang B and Erlang C fields show the predicted service level which would be achieved by these combinations of trunks and agents. On a working site the ACD reports should be substituted for the theoretical values. Many different combinations of agents and trunks can be modeled in this manner and the most economical approach discovered quickly. The Erlang B column will indicate how much traffic is being lost or overflowed. If the breakpoint on agents is quite low, it may be necessary to recalculate the model using a greater number of trunks. The larger number of trunks will have the effect of increasing the occupancy of the agents and improving the return on revenue for each additional agent. The number of trunks should not be increased beyond some factor times the predicted maximum number of calls offered during the study period. This factor must be estimated according to the incremental return from the increased occupancy minus the incremental cost of the additional trunk.

This is a simple way of predicting exactly what effect each combination of trunks and agents will have on the revenue production of the ACD. It should also be noted that the service levels at this maximum

revenue-production breakpoint are still high. Using the formulas from the previous chapter demonstrates that the predicted delay on all calls will be less than five seconds and the delay on delayed calls will be less than thirty-six seconds. This is a better service level that most ACD's require, and yet it is still a revenue-maximizing point. In an ACD where the revenue per call approaches one or two hundred dollars, the service level would be less important than finding this breakpoint and staffing accordingly. Very low service levels are mandatory to achieve the maximum in economic efficiency from the ACD when the revenue per call is high.

This type of analysis must be conducted for different periods of the day and different days during the year. In an ACD which does not experience the smooth traffic applied in this model, the analysis becomes more complicated. Depending on hiring practices, the ACD will have to be optimized either for an average traffic load or within each segment of the day. If the ACD is optimized over the entire day, this will produce lower service levels at the breakpoint in order to balance the diseconomies experienced during low traffic periods.

In addition to resource allocation problems the ACD manager will be faced with product mix dilemmas. These arise when two or more gates require additional agents or trunks, but it is not known what application will produce the maximum revenue. This is distinct from the revenue maximization problem presented above because an efficient product mix concerns the application of two or more resources which are interdependent. Adding one agent to the Tours gate will take one agent away from the General Sales gate.

LINEAR PROGRAMMING

A common method used in economics to determine product mixes is linear programming. This method requires the assumption of linearity between the variables. It has to be assumed that the addition of one unit of production will produce a corresponding increase in the output and that this increase will hold for a given range of additional inputs.

This is the same assumption discussed under the section on constant marginal productivity. This assumption can be useful if the ranges over which it is used are reasonably limited. In order to formulate a problem in linear programming, it is necessary to state the performance objectives of the ACD center as a

linear function.

To make the basic approach clear, take the example of two gates with a known number of assigned agents and a different revenue-production function at each gate. The ACD is configured such that each caller must be screened by the first gate and then transferred to the appropriate agents in the next gate. The ACD is a promotion center selling opera records and rock records via an 800 number advertised on television. Each opera record sells for twenty dollars and each rock album sells for twelve dollars. Due to differences in the calling rate, it requires one agent in Gate A and two agents in Gate B, on the average, to make each opera record sale per gate. For the rock albums, it requires ten agents in Gate A and five agents in Gate B to make each sale. There are twenty agents working in Gate A and forty agents working in Gate B. The stated objective would be:

Maximize: REVENUE = 20 Opera + 12 Rock

The next step is to state the limitations on this revenue production as a linear equality. Naturally enough there are constraints on how much revenue can be produced at either of these gates. These constraints are imposed by the available time, the total number of callers, the space available for extra agents, training, etc. The constraints in this case are set by the number of agents required in each gate to handle the transaction.

Assuming the agents can be moved back and forth between Gate A and Gate B, the linear constraint functions would be:

1. 10 Rock + 1 Opera is equal to or less than 20
2. 5 Rock + 2 Opera is equal to or less than 40

These constraints are then solved as a simultaneous equation to obtain the number of opera and rock albums which should be sold to produce the maximum revenue from this ACD operation.

10 Rock + 1 Opera = 20
5 Rock + 2 Opera = 40

The second equation is multiplied by -2 to solve for the opera value.

$$\begin{array}{r} 10\ \text{Rock} + 1\ \text{Opera} = 20 \\ -10\ \text{Rock} - 4\ \text{Opera} = -80 \\ \hline -3\ \text{Opera} = -60 \end{array}$$

This solution is then inserted into the first equation to solve for the rock value.

10 Rock + 1(20) = 20
10 Rock = 0
Rock = 0

The values for rock and opera are then substituted into the original maximizing equation and the solution is:

Revenue = 4 Opera + 12 Rock or 4(20) + 12(0) = 80 dollars of maximum revenue

to be derived by selling only opera albums. Obviously, this is the maximum amount of money the ACD can produce from this mix of inputs and the rock albums should not be sold at all.

This is a highly simplified example, but the same principle can be applied anywhere in the ACD that two or more resources are required to produce one output and the mix of inputs must be maximized.

The importance of using economic principles in establishing the configuration of an ACD center cannot be overemphasized. The service level should be a function of the ACD's optimal revenue state; the service level should not be allowed to drive the ACD operation without reference to an objective standard. The production of an optimal return on investment is a much clearer and more easily analyzed quantity than a simple desire to answer such and such a percentage of calls within some arbitrary interval.

CHAPTER FIFTEEN

DEFINING SYSTEM PARAMETERS

The key performance parameters established for gates, trunks, and agents determine the call-handling capability of the ACD system. This section will consider performance parameters for the system in general and for the gates, with subsequent sections covering trunks, agents, and the network. "Gates" are the same as the "splits" of AT&T, or the "groups" of IBM-Rolm. A gate is simply a collection of trunks and their associated group of answering agents.

The ACD gate is much like a gate in a train station. It is an avenue through which a large volume of traffic passes to reach its destination. Most of the ACD's discussed herein will be capable of having several gates, or call-handling areas, set aside. The Rockwell system offers a maximum of 32 gates, and the Teknekron Infoswitch^{R}, for instance, allows fifteen functional separations within the call stream.

Each of these gates is typically assigned to one homogeneous call-handling function. The reason for this is that calls are evenly distributed within each gate only for the specific trunk bundles that terminate at that gate. Keep in mind the type of automatic call distribution that is offered by each vendor.

The most obvious distinction is between automatic distribution and uniform distribution. With automatic distribution, calls are assigned to agents based on the length of time any given agent within a gate has been idle between calls. The agent who has been idle and available the longest will be assigned the next call. This insures an even distribution of the workload among the agent force. However, this only applies within a given gate. Each gate has automatic distribution--hence, even workloads--but there will be uneven distribution between different gates because the inflow of traffic to the different gates is distinct and the distribution scheme is only even within a gate.

The other type of distribution mechanism is "uniform call distribution." The confusing aspect of this is that both automatic and uniform distribution schemes are sold in machines that are labeled "automatic call distributors." Unlike automatic distribution, uniform distribution does not provide an even balancing of the work among the agent force. The AT&T ACD, the IBM-Rolm CBX, and the Teknekron INFOSWITCH^{R} are uniform call distributors. This means that agents are assigned calls based on a rotary. The next agent in the rotary will receive the next available call--not the agent who has been idle the longest. The INFOSWITCH^{R} allows for this uneven balancing by allowing a dynamic reconfiguration of agents on a regular basis. This will move agents out of the "hot" seat and into another section of the rotary that is not hit with calls quite so often. The manager should be aware of the type of distribution in order to account for these hot spots.

In the special cases of gate interflow, or secondary assignments between gates and multi-node overflow, there is some additional balancing effect between gates, but the only way to insure an even distribution of calls is to group agents within a single gate. Interflow refers to ACD systems which allow calls to be handled by a back-up agent in another gate if the primary agents who would normally handle the calls are busy. Again, this mechanism varies from machine to machine. The Wescom ACD and the Teknekron ACD have programmable incoming call routines which allow the user to program in a series of steps to determine where the call should look and how long the delay should be between successive steps. The Rockwell ACD does not have this mechanism and provides interflow by immediately looking for a primary agent when an incoming call is recognized. If there are no primary agents available, this ACD immediately looks for a secondary agent. Failing in this, the call drops into a waiting queue and the Rockwell ACD continues to look for either a primary or a secondary agent until the call is answered or abandoned.

The actual operation of the gate, at the software level, should be understood by the manager in order to effectively determine the service levels and performance parameters for the various gates. The ACD manager should exert a strong influence on the actual performance levels the ACD is expected to attain. In order to exercise this influence a careful study of the existing and future performance parameters must be undertaken.

Choosing and enforcing a rational set of perfor-

mance parameters for the ACD is one of the most mysterious and most important aspects of effective management. In ACD sites across the country, from the largest Rockwell International dual ACD to the smallest Teknekron machine, there is a universal chorus of shrugged shoulders when performance criteria are questioned. The performance criteria for the system, the agents, and the trunks, are either arbitrary or handed down from a management roost that is far from the nuts and bolts of the communications operation.

Establishing performance parameters is the single most important thing an ACD manager can do--provided it is done well. There is little in the ACD that is not shaped and driven by the service level. There is little that is not affected by the manager's decisions in this critical area.

It is at the gate level that the actual real-time and historical call-handling statistics for the ACD system are collected. It is at this demarcation point that the most important events take place. This is the first chance the caller has to bristle at a delay announcement or be shunted off to a half hour of delay queue "easy listening." This is the area within which the caller on your WATS can sit and burn up expensive minutes waiting for an agent. This is the interface between your ACD and the outside world. It is here that the customer measures the quality of your service and makes the initial decision that your service is good, lousy, and indicative of still worse to come. It is at the gate level that trunks and agents interface and determine the actual quality of service the ACD center is offering the outside world.

Knowing the importance of this interface and sensing the need for a close, accurate, and critical analysis of those calls wandering in that no-man's land between seizure of the trunks and "Hello. May I help you?" is crucial. But there remain the questions," What exactly should I know about this area?," " What types of things can I know about this area?," and "How good is good enough for those callers vying for service?"

The ACD manager should know three things about the call-handling process at the gate level. The manager should know the functional configuration of the switch, the volume of traffic, and the efficacy of the call-handling service levels.

FUNCTIONAL CONFIGURATION

The functional configuration of the switch refers to the assignment of call-handling functions within the various gates of the system. This rubric covers the standard and optional operating features of the ACD and the manner in which the manager has them deployed. The functional configuration determines what types of calls will be handled as a separate class, the priority which is placed on calls of each type, and the agent teams which are assigned responsibilities within the gates handling those call types.

The functional separation of the incoming traffic into different types will be partly a function of the following: the corporate budgetary structure; the data-base requirements to handle each call type; the manager's analysis of the proper traffic mix; and the training needed for agents.

In one banking application there are seventy-five distinct call types that are handled within a single gate. This is because the corporate budgeting is done by a higher level division which only recognizes one class of calls financially--even though there are a multitude of types within this financial class. Consequently the agent training required is extensive and the agents' jobs difficult.

In another banking application, there is one ACD which handles credit card general service and another ACD a short distance away, but owned by the same corporation, handling credit card authorizations. In this case the switches are under-utilized because the budget enforces a complete split between financial classes.

These are the two extremes. The ACD manager must strive to hit the rational mean between the penurious and the extravagant.

The gates should be configured to account for economic differences in the volume of traffic. That is, the manager should take into account both the cost per call and the revenue per call for each avenue of incoming traffic. The cost of the trunks necessary to carry the traffic should also be considered. Many ACD systems split the WATS and local traffic into separate gates in order to save the lost WATS time spent queuing behind local traffic. In some cases the lost revenue can be substantial, in other cases minimal.

Citicorp studied their tripartite gate system and discovered that the separation of WATS and local was

saving only twenty-five dollars per month. For this it was hardly worth the effort to manipulate the reports for the separate gates.

For traffic types where there is a very high cost per call and a low revenue per call, as opposed to traffic types with a lower cost per call and a very high revenue per call, there should be a functional division reflected in the gate structure. Better service should be provided at the high dollar gate and lower quality service at the bargain basement gate. Another useful functional distinction is that between information gates and revenue gates. The airlines will maintain a few flight information gates and also a few ticket sales gates in order to separate the service functions from the revenue functions.

The database requirements limit the functional configuration of gates by virtue of the sophistication of the agents' training and the computer which supplies the call-handling information. In every ACD application, small, medium, and large, there is some requirement that the agent staff serve as a conduit for information between the customer and the corporate service.

Airline ACD agents are trading flight information for ticket reservations. In the credit card industry, the agents are trading authorization requests for the consumer's continued usage of the card. In the utilities industry, the agents are providing an information service in exchange for goodwill and the continued friendly regulation of the utility service. Each gate should be limited to a number of call types for which the agents can be readily trained. As the cost of training goes up, so do the costs of recruiting and the costs of turnover in the staff. The configuration of the gates can have a significant impact on all of these by providing for readily trainable agents divisions.

Balanced against these centrifugal forces which tend to produce a multitude of gates there are centripetal forces which act to consolidate disparate functions into single gates. There are some diseconomies in smaller gates, however.

Within limits, the call-handling efficiency of a larger group is greater than a smaller group. As the staff is divided into smaller and smaller gates, the efficiency, or total traffic capacity, of the system will decrease. The benefits of automatic call distribution and an even assignment of calls within the system can only occur on a gate basis. With the sepa-

ration of the center into more and more gates, the workload will become more and more uneven and thus more expensive. There are also costs associated with the additional supervision that may be necessary in the smaller groups which occur in a multi-gate system. The reporting activity needed to keep track of a multitude of gates will be more complex than that required for a single gate or a few gates within the system.

All of these factors must be balanced against the equally compelling reasons for dividing the call stream into distinct units. This is a judgement call. All of the agents within a particular gate and any agents assigned to interflow or overflow responsibilities should be trained to handle that type of function. In the credit card industry, managers typically set aside one group for credit card authorizations, one gate for general service on complaints and information, one gate for security, one gate for problem calls, and possibly a few miscellaneous gates for special purposes such as training or assistance.

The airlines set up their gate structure so that General Sales will have one gate, Tour Offices another gate, and high dollar account customers a gate of their own. Each gate typically has a separate phone number and each gate has an associated bundle of trunks that carry calls of only one type or of associated types. Some systems separate gates by the trunk bundles and devote gates to different types of regional service. However the gates are organized, there should always be an effort to maintain some kind of functional identity within the various trunk groups feeding that gate. This allows for economies in the database presented to the agents in that gate, as well as simplified training, monitoring, and supervision of the agents. If agents within one gate have a large number of extremely complex tasks, the management of that gate is going to be similarly complex.

The functional configuration of the ACD center needs to be studied in conjunction with the traffic volume of the switch. The traffic studies completed for Part IV provide the raw information necessary to understand the traffic characteristics of the ACD center. The traffic analysis will determine the trunking and staffing levels required at each gate. The long-term projections will allow the manager to intelligently plan for the expansion of the ACD center. Each gate will operate with a traffic stream of different patterns and distribution.

The manager needs to understand this traffic flow in order to adequately staff the center. The different

types of traffic all call for a slightly different staffing philosophy. Gates which have smooth traffic patterns can be staffed at constant levels. Gates experiencing rough traffic need a wider margin of safety in engineering the service levels and staffing requirements. The manager should use the ACD reports to acquire a thorough understanding of the traffic patterns at each gate and manage those gates accordingly.

The volume of traffic should be analyzed in terms of the number of calls offered at the gate, the number of calls handled at the gate, and the number of calls abandoned at the gate.

An offered call is defined as one placed by a caller who dialed the ACD, with every intent on receiving something for the trouble, and who actually received an answer from the ACD center--whether that answer was a delay recording, a busy signal, a queue with music, or the humane voice of an agent. It often happens that the caller will receive a busy tone and will blame the company being called for the poor service. The busy tone, however, may be from the central office. The caller either cannot seize a trunk which will carry the call, or the lines to the central office are overloaded and the caller will receive a reorder tone. For a call to count as offered, it must seize a trunk and actually reach the ACD--even though the caller may hang up immediately upon hearing the delay announcer. All the calls that actually take up, however momentarily, the call-handling capabilities of the ACD are counted as offered traffic.

There are differing philosphies of ACD management in the reporting organization of this type of offered traffic. Some callers will dial the wrong number, others will hang up the second they hear the delay announcers telling them to prepare for a long seige. Managers within the telephone operating companies feel that traffic which releases almost simultaneously with an answer cannot realistically be counted as offered traffic. Their feeling is that such short hits on the line do not qualify since the caller was hardly serious about getting through and no amount of careful engineering, and only very reckless overstaffing, would allow a center to handle such traffic.

Those ACD's which are revenue-producing centers rather than cost centers, typically have managers who feel quite the opposite about the problem. These centers make an effort to engineer their switches to include all the calls which are offered to the gate regardless of the length of time they are willing to

wait for an answer.

Both philosophies have merit and the manager must make an independent decision on this score. Typically the reporting structures of ACD's include the abandoned calls in their reporting of the traffic at the gate; the manager will usually not have much choice in the matter. Sometimes an effort is made to account for this quick release traffic through an analysis of the reports showing the average delay to abandon.

The number of calls handled is treated in a similar fashion in most ACD switches on the market. In an ACD the calls handled are considered to be only those calls which eventually reached an agent console and were then answered (the calls will include transfers and referrals throughout the system). These calls must reach the ACD agent consoles via a trunk or they will not be counted in the handled traffic. This means that internal calls between agents, assistance calls, and so forth will not appear in the handled traffic figures of the switch. Calls which are transferred from gate to gate in the ACD will be counted because they entered through a gate via the typical three- or four-digit (77xx) dialing sequence. Calls that are transferred between agents via direct dial to another position will not be counted in the handled traffic because they did not cross a gate in the process. The egress and regress through the boundary lines of the gates determines what counts as handled traffic.

Abandoned traffic is counted similarly in every switch. This consists of the calls that were abandoned before the caller was connected to an agent console. The incoming call must seize a trunk, enter the ACD through a gate, and either hang up before reaching the agent or hang up in the delay queue before being reached for an answer.

The desired service level should be considered for the system as a whole and for each particular gate. For revenue gates the procedure of marginal revenue analysis outlined earlier should be applied. In the non-revenue gates there is little need to assign trunks with a very small probability of blocking (less than .10). In most cases the blockage at a non-revenue, or particularly at a captive audience gate, should be well above this level.

There are many ACD's operating non-revenue gates with the objective of answering eighty percent of their calls in forty seconds or less. At this rate over twenty percent of the callers eventually abandon the queue.

The ACD manager should engineer the queuing structure of a non-revenue gate very carefully. A dollar amount should be chosen that the organization is willing to commit to non-revenue information functions and the gate built around spending that amount or a little less. The worst mistake in the configuration of non-revenue gates is to provide a high grade of service on the trunks and a low probability of answer within the queue. Under these conditions, the agent staff will be terribly overworked, the queue will be excessively long, and the abandonment rate will be such that the maximum delay period is experienced by the majority of callers.

Under non-revenue conditions it is wiser to configure the gate with a nearly one-to-one alignment of trunks and agents. In this manner the effective occupancy of the agents will not be artificially raised, and the cost of blocked traffic will be borne by the central office instead of the ACD. There is no point in providing queue service for calls that stand a high probability of never being answered. ACD managers may make the mistake of judging a configuration by the percentage all-trunks-busy figures without looking at the related staffing levels and cost functions. In a non-revenue gate this results in a considerable misallocation of capital.

There is also considerable room for educating the calling public. Telephone traffic is essentially random. Calling patterns, however, tend to group themselves around a known, or knowable, distribution curve. Business calls tend to reach their peak volume between 10:30-12:00 a.m. and 1:30-3:00 p.m. In a truly random environment, one must simply live with this distribution and plan for the busy hour.

In the non-revenue ACD with a captive audience (an audience who must use your service), there is little reason to accept random calling patterns. The distribution curve can be smoothed substantially by educating the callers. The ACD manager can encourage calls at off-peak hours through the circulation of a call distribution chart with the normal correspondence and billing statements. The public can be educated to make much more economical and efficient use of the facilities. This education effort has virtually no cost and may realize enormous trunk savings if it has even a small impact.

When examined closely, the generally held assumptions about the service level turn out to be surprisingly elusive and ill-defined. Of course, as manager, you wish to answer at least 80% of your calls in twenty seconds or less, but just what does this mean? The

yardstick against which the service level is being measured turns out to be a victim of relativity.

Consider the theoretical service level just mentioned: answering 80% of all offered traffic within twenty seconds or less. This service level implies that any call which is forced to wait in a delay queue longer than twenty seconds will count against the manager. For each call delayed longer than twenty seconds, the reported service level will be decreased, and the manager will fall further and further from the optimal goals set for the ACD.

This service level does not imply anything directly about the number of calls the ACD center failed to answer or the cost of failing to answer those calls. Nor does it say a thing about the quality of the telephone conversations themselves, nor dollar sales to callers, nor the efficiency of agents in other duties related to answering the call.

The reported service level will vary at different call volumes. If one call is delayed longer than twenty seconds among ten calls during a half-hour period, the reported service level will read 90%. This indicates that the manager was only ten percent below the performance parameter of 80% of all calls answered in twenty seconds or less. How good is this? There is no indication whether all ten of those calls were answered in less than two seconds or somewhere between eighteen seconds and the twenty-second limit. If one call is delayed longer than twenty seconds from amongst one hundred calls during a half-hour period, this will result in a reported service level of 99%.

The speed of answer on the incoming calls is the one factor on which management is most insistent. This is probably because it is, on the surface, one of the easiest to understand. There is something immediate and startling about answering 99% of the incoming calls within five seconds or less, but these numbers fail to relay the entire story.

Average speed of answer is an important statistic, but it must always be considered in the context within which the ACD is operating. Average speed of answer is defined as the time interval between recognition of the trunk seizure at the ACD and connection of the caller to the agent console. Since the time required for connection in a modern ACD is virtually nil, what the average speed of answer is really timing is that

interval the caller spends in queue listening to a delay recorder, music, or silence--growing ever more angry waiting for an agent to answer. Keep in mind that this is speaking about the "average" speed of answer. The chapter on teletraffic engineering provided some additional hints about what an average speed of answer of, say, five seconds means to the person who waits the longest in the accumulation of this average figure. While the average delay to answer may be five seconds, it is likely that someone else has been waiting much longer.

An ACD center should not be managed around some arbitrary average speed of answer. For a revenue-producing ACD, the average speed of answer will be a derived function of the revenue-maximization point. However many agents are required to reach that optimal revenue point will determine the average speed of answer which callers experience. If the corporation wishes to modify this number for non-economic reasons, this will have to be factored into the mix. In a non-revenue ACD, or non-revenue gate, a designated rather than derived average speed of answer is more reasonable. In this case the cost of each average speed of answer should be determined and a figure selected that management feels is a reasonable investment for continued good service and customer satisfaction.

PRINCIPAL MEASURES

The parameters of principal importance for the system manager fall into two related categories:

1. The service duration for each call.
2. The speed of answer on each call.

Within these broad categories the service duration is described by three factors:

A) The average handling time per call.
B) The average talking time per call.
C) The average work time associated with the call.

The speed of answer for each call also has three associated factors:

A) The average speed of answer.
B) The average delay in queue prior to answer.
C) The average number of calls "held" in the queue beyond a predetermined time limit.

The average handling time per call is defined as

the sum of the average talking time per call plus the average after-hang-up-work time per call. The average handling time is clocked from the moment the call is connected to the agent console (note that the time is not clocked from the moment of trunk seizure, but from the moment of agent connection in order to avoid confusing queue delays with handling time) until the agent completes any additional hang-up work by signalling to the ACD computer readiness to accept another call.

The after-hang-up-work time is all the time logged from the moment the call is completed (that is, the release button is pushed or the ACD system signals the console that the trunk has released) until the agent pushes the button to accept another call.

The average delay in queue, then, is really another way of stating the average speed of answer. The distinction between the two was mentioned earlier. The average speed of answer is the delay time on all calls, including those which were answered immediately. The delay in queue is the average waiting time before answer of the delayed calls--excluding the calls which were answered without any delay at all.

Once the service level is set for each gate, and for the system, this number can be used to generate all the other numbers in the system. The service level itself is read directly off either Erlang tables or the ACD reports corresponding with the number of agents required to reach the revenue-maximization point. There are some variables that are less variable than others: the average handling time is somewhat fixed, but susceptible to management; the number of calls offered is fixed, but again can be controlled--particularly by limiting trunk availability in a non-revenue gate.

The service level determines, from the number of calls offered, how many calls will be handled and how many calls will be abandoned. The service level sets the standards for the average handling time, the average talking time, and the average work time the manager expects to achieve. Of course, the service level directly states the average speed of answer, the average delay in the queue, and the number of calls that will be held for any given period of time. Staffing and trunking parameters are then derived from the service level. It should be emphasized that the service level is not some figure plucked from the traffic engineering handbooks. The service level is an objective statement of the center's maximum revenue production or cost minimization point. This point is

then translated into traffic engineering terminology and converted to the required average speed of answer, delay queue length, call-handling standards, etc., which allow constant assessment of the ACD's performance.

DEFINING TRUNKING PARAMETERS

Trunking is one area in which the knowledgeable system manager can save a great deal of money. Telephone bills for a small ACD center with eighty to one hundred agents can easily run thousands of dollars per month. An extraneous Band Five WATS line, at 450 dollars per month, can provide substantial savings if it is replaced with a cheaper line or taken out entirely.

There is no reason whatsoever to accept the judgement of the facility vendor about the operation and number of trunks that a system should install. The sophisticated ACD's, with their proliferation of trunk usage reports, have shown, over and over again, that ten to twenty percent of the leased circuits may not be operating at any one time. An even greater proportion may be working at less than optimal performance.

One major ACD vendor advised a mechanical ACD customer to configure the system with one hundred trunks and one hundred and twenty agents. With such a configuration, all incoming calls would be answered quickly, but in the meantime, the twenty extra agents would be twiddling their thumbs. Facility vendors are sophisticated in a number of areas, behind the times in others. The development of accurate trunking reports is one area in which some vendors still need improvement. There are prudent and reasonable levels of service that should be offered on the trunks, rather than simply striving for the best service possible. The engineering principles explained earlier, and more importantly, the trunking reports from the ACD, will provide enough information for the ACD manager to fine-tune the trunking requirements to any level of detail.

The competitive arena that telecommunications has become has brought with it many low cost alternatives to the public telephone service offerings. The manager should be aware of all the alternative services offered

by the specialized common carriers and private microwave dealers, and of the potential for installing private interoffice phone lines. In order to adequately understand and control trunking costs, the ACD manager must be familiar with the tariffs and aware of the competitive offerings.

The tariffs provide a wealth of information. They are enjoyable reading for slow afternoons because they raise hopes for trunking economies formerly unimagined. A basic perusal of the tariffs will help the ACD manager become familiar with these documents and their application. They are available for public inspection at the Library of the Federal Communications Commission, the state Public Service Commission, and the Telephone Companies. The FCC tariffs covering the list of rate centers and central offices should be examined. The tariffs on WATS service and the other types of leased line service such as FX and RCF should be studied.

The basic types of service from interexchange carriers which are important to an ACD center are as follows: DDD, WATS, FX, Private Line, and RCF. DDD, or Direct Distance Dialing, is familiar to everyone. The ACD center will rarely use this except on outcalls. Some very small centers may require customers to call DDD or allow collect calls to be accepted, but this is not an economical use of a sophisticated ACD. Typically the revenue per call and the call volumes will be large enough to justify some type of WATS calling service into the ACD with DDD used only for occasional outcalls.

WATS, or Wide Area Telecommunications service, provides a bulk rate for long distance calls. WATS service is established with different areas of service depending on the portion of the country the incoming telephone call center wishes to service. The charges for the different WATS areas are dependent on the area covered and the number of telephones each band will reach. Many ACD's use the broadest WATS area exclusively--which accepts calls from every state in the U.S., except the state in which the ACD is located. Sometimes a greater economy can be gained by seriously studying the WATS requirements and only buying the areas that match the incoming traffic for that portion of the country serviced by the ACD.

WATS OPTIMIZATION

The Interstate WATS tariff established by AT&T, along with the Foreign Exchange services, continue to

provide the majority of communication facilities used by incoming call centers. Some telemarketing centers that make outbound calls are experimenting with the plethora of interexchange carriers competing in the Out-WATS and DDD businesses; however, the AT&T tariffs still constitute the backbone services for most centers.

The AT&T WATS tariff is really a marvel of mathematical complexity. The software routines listed in Part VI allow a manager to model the WATS tariffs for any location around the country using any geographical coverage range and any amount of calling traffic. After a considerable period of time modeling various configurations and call volumes with this software, it becomes obvious that AT&T has designed a tariff which is very insensitive to volume shifts between the different coverage bands. It is very difficult to achieve any economies by splitting traffic among different bands. There are some applications which allow considerable savings even under the current WATS tariff.

The other key features of the WATS tariff are the sixty second minimum billing period per call and the provisions for group average billing and usage hours averaged over all lines in service.

The sixty second minimum billing period is currently under review by AT&T. The California tariff may become the model for the rest of the country with usage billing directly related to connect time and a transaction fee per call to insure a profit on very short calls. As it stands now, any call which reaches an ACD center, whether one second long or fifty-nine seconds long, may be billed as if it were connected for sixty seconds. The "may be" is a critical factor for the ACD manager to understand because there are ways to avoid being charged an excessive amount for very short calls. AT&T's billing system calculates the sixty second minimum charge by collecting all of the seconds of use during a month then dividing by the total number of calls counted during the month.

If the average number of seconds per call is less than sixty seconds, the total bill is calculated by taking the number of calls times sixty seconds and charging for that adjusted amount of time.

For example, if a center takes 100 calls in August that are fifteen seconds long, the total usage on the WATS lines is 1,500 seconds. However, the bill from AT&T will be for 100 calls times sixty seconds because the average connection time per call was only fifteen seconds instead of the tariffed minimum of sixty seconds.

There is a way around this dilemma by using the group average billing feature in the WATS tariff. The tariff allows a business to combine many different kinds of phone calls in a single center through group average billing. The only requirement is that each set of calls must have a common hunting point; that is, each type of call must be able to overflow into groups or lines carrying other types of calls. They do not have to actually overflow; they merely have to be able to overflow.

A common arrangement, then, is to install fifty or more WATS lines in a hunt group that will carry very short calls from data transmission equipment. The peak hour requirement for this traffic is calculated to be about forty lines rather than the fifty actually installed.

This group of lines taking very short calls is then allowed to hunt into a group of 200 to 600 WATS lines taking calls that average over sixty seconds apiece. These calls are group billed with the first set of lines but cannot overflow to the first group in the hunt; therefore, none of the callers will mistakenly receive a carrier tone from the data equipment.

The ten empty lines between the two groups insure that under normal circumstances there will be no overflow from the data equipment down into the agent groups. If an overflow does occur, there is really no significant adverse effect as the data transmission equipment will simply hang up and redial.

The effect of all of this is that the telephone company will add together all of the short call seconds and the long call seconds, divide by the number of calls, and come out with an average very near sixty seconds. The short calls will be answered essentially without any usage charges, and the long calls will not be billed for any time above sixty seconds. This technique can significantly reduce the impact of the new WATS tariff.

The other portion of this tariff that must be monitored closely is the effect of the "average hours of use" provision. Under the old WATS tariff, the amount of traffic on each line was measured individually. This allowed the hours of traffic on the first few lines to reach rate steps which were very inexpensive and brought the overall cost of the center into the twelve to fourteen cents a minute range. The current WATS tariff does not allow this. AT&T calculates the total number of traffic hours in a month on all lines and then divides that total by the average

number of lines which were in service during the month.

This means that a center which handled 8000 hours of traffic during September on 400 lines is only credited with 20 hours of average traffic per line. This 20 hours of traffic is in the lowest discount step of the tariff and is charged at the highest rates--even though the first line may have carried over 100 hours of traffic. There is really no effective way to beat this tariff feature; however, it should put the center manager in a very cautious frame of mind when considering the addition or deletion of trunks.

At the same time that AT&T instituted this feature of the tariff, they lowered the monthly charge for idle lines substantially. This led to a perception that unused WATS capacity was very cheap. This is absolutely untrue because each unused line reduces the average hours per line for the whole group and artificially raises the communications cost of the center.

All in all, this is a fascinating tariff with a number of quirks that must be understood thoroughly to gain the maximum benefit.

Communication managers should also be aware that there is a continual push to again revise the WATS tariffs both by AT&T and the business users. The biggest single impediment to AT&T marketing efforts at the moment is cost-based pricing. This legal requirement means that they cannot discount their services to large users without providing evidence that the differential is based on verifiable economic advantages to AT&T in providing that service.

Without the ability to discount to their large customers, AT&T will lose those large customers to private networks and the unregulated interexchange customers. Since a handful of very large customers provide a large portion of AT&T's total revenues, they cannot afford to lose this group. Telecommunication decisions of that magnitude tend to be five- to ten-year investments and AT&T does not want these accounts out of their influence for that long a period.

There is an overwhelming glut of transmission capacity which will peak in the late 1980's and early 1990's. An excessive amount of fiber optic capacity is being installed along railroads and pipelines throughout the country at the same time that high power multiple beam satellite systems are in development. In addition, the newer technology in digital signal pro-

cessing chips will obsolete the 64 KBit voice encoding standards now in use and make 16 KBit and lower voice transmission the new standard. These events all mean that a vast oversupply of capacity will have to find users.

The most likely users initially are the unregulated interexchange carriers that need a competitive advantage to gain market share against AT&T. As prices start to drop when all of these transmission advances converge, AT&T cannot afford to be left with a declining market base and an enormous installed transmission plant. AT&T, and everyone else, needs the large corporate accounts that will find ways to soak up this excess capacity--in much that same way as the exponential growth in data processing capacity has been overwhelmed by the invention of new requirements.

Currently transmission facilities cost about $7.00 per channel mile to install. As that cost approaches $1.00 or less, the entire concept of telecommunications will be radically restructured.

WATS provides a significant opportunity for AT&T to capture these large corporate accounts and still meet the requirement for cost-based discounts. A very large portion of WATS (estimates range up to 65%) is kicked back to the local intraexchange companies for access lines, billing services, and miscellaneous charges. If AT&T can establish a direct connection between their point-of-presence (normally a # 4ESS switching center) and the customer's office via T-Carrier, Fiber, or Microwave, then a decisive argument can be made to the regulators that a discount should be provided to the users with these facilities installed. Under these circumstances, large users could see 20% to 30% discounts in their WATS rates.

Another angle of this argument is that AT&T's network is becoming more automated and more sophisticated each year. As their digital backbone network is completed and the switching control software in the switches becomes more sophisticated, there is less and less reason for WATS to be an unintelligent transmission service. AT&T needs to retain a large WATS customer base in order to sell the value-added intelligent network services it will undoubtedly introduce over the next few years.

WATS is still the superior communication medium for ACD centers. This is because WATS has both broad geographic coverage and the ready acceptance of its service by consumers. The current tariff simply requires a more analytical approach to the use of WATS

in order to gain the maximum benefit.

Implications of the WATS tariffs for incoming telephone call centers include the following:

1. Users may find it less economical to swap lines in and out seasonally, since installation rates have risen to $186 a line (from $100) and the minimum monthly charge has dropped from approximately $240 to $32 per line.

2. Some users may find it more economical to acquire more in-WATS lines, since the minimum cost of lines has fallen.

3. Very few networks in existence in the 80's will prove economical for the changed pricing of the 90's. Many companies will radically change their networks, preferring to concentrate more on foreign exchange and other fixed facilities such as the high capacity T-Carrier services.

4. Optimal networking will become more and more difficult in coming years since the present WATS restructuring is only the beginning of at least three more years of fundamental changes in U.S. telephone calling prices. Traffic information generated by modern, electronic ACD's will be absolutely critical.

For incoming call centers, such as an ACD center, WATS service is invaluable because it allows customers to dial what is to them a "free" call. This greatly encourages customers to call and improves the revenue-production of the ACD.

FX LINES

Another type of service is FX, or Foreign Exchange lines. A foreign exchange line allows calls placed to or from a distant city to be made without any toll charges. The FX service is billed on a mileage charge per circuit and can be extremely valuable as a replacement for circuits into very high traffic volume metropolitan areas. In most cases, a single FX circuit will cover a great percentage of a major city. When installing an FX circuit, the ACD manager should specify the central office at which the service is to terminate. Since charges are by mileage, the FX line should terminate in the central office closest to the ACD.

FX lines should be combined with Remote Call Forwarding (RCF) in order to gain the maximum economies. A random population of calling traffic into a

group of ten FX lines (assuming you are blocking less than 50% of your traffic) will result in a high number of hours on the first line, less traffic on the second line, and a relatively small number of hours of traffic on the last two or three lines.

This means that the last three FX lines, which you may be paying $800 a month for, are carrying very little traffic. Instead of filling a traffic requirement with FX circuits, the last few lines in a group should be RCF circuits that grab the overflow from the FX lines and transfer them into WATS lines based at the ACD center.

A simple analysis will show where the breakpoint is in any FX bundle. Assuming WATS for a large center is about $.25 per minute, anywhere the cost per minute of traffic on the FX is greater than $.25, the call should be remote call forwarded (RCF) to WATS. In the case of an $800 FX circuit, this means that any line which is taking fewer than 3,200 calls per month, or less than 53 hours of traffic per month, should be replaced with an RCF arrangement.

The other advantage of RCF is that FX lines are typically out of service 3 to 10% of any given month. The RCF lines provide a mechanism for bridging these service outages by providing your customers with an effective completion path even when the FX are down.

FX lines are slightly more expensive now than in the past, with every indication that FX lines under 150 miles long will see additional price increases in the near future. In addition, the process of divestiture necessitated the addition of "open-end minute" charges on FX lines. These open-end charges run from three cents to seven cents per minute of calling traffic dialed into the open end of the FX line and constitute a subsidy to the local operating company for switching calls into the FX circuit from their local territory.

There should be significant pressure to reduce FX costs as the supply of transmission facilities increases and as AT&T trims down their operation to reduce overhead expenses.

TIE LINES

Tie lines, or intermachine trunks (IMT's), are another type of service which is important to the ACD. A tie line connects two ACD's or two switchboards in distant cities by means of a direct connection which is free of toll or message unit charges. A tie line is

distinct from an FX line in that the FX line is terminated in a distant central office, while the tie line terminates on customer equipment.

The implementation of FX and tie lines should be decided on the basis of traffic volumes and economics in the same fashion as the WATS circuits. The ACD reports will provide a clear indication of the calling patterns and provide the manager's traffic engineering staff with the information necessary to find the economic breakpoints for each type of circuit.

There are several new multiplexing products on the market which make the implementation of four-wire voice circuits, like IMT's, even more economical. One product, the Com2 line multiplexor from Storage Technology Corporation, is being used by American Airlines and others with great success. American Airlines has been experimenting with the Com2 in their large tandem network. This product makes nine circuits out of five private lines and provides significant cost reductions for four-wire voice circuits and data circuits over certain distances.

T-CARRIER LINES

The newest tariff that should be of great interest to large center managers is the high capacity digital service using T-Carrier lines. This tariff is currently the lowest cost terrestrial service available into most major cities.

A T-Carrier line is simply a digital transmission facility with appropriate electronics to allow it to carry 1.544 million bits of information per second from Point A to Point B. This is equivalent to roughly 24 individual 3002 voice grade channels. A single T-Carrier circuit between New York and Los Angeles can carry the equivalent of 24 FX lines worth of traffic.

Since a T-Carrier line is a digital path, any type of traffic which can be digitized can be transmitted via these lines. Voice, data, fax, etc. can all be combined for transmission through these facilities.

It is also possible to use techniques such as adaptive differential pulse code modulation (ADPCM) to encode the voice conversations entering the T-Carrier circuit at 16 kilobits or 32 kilobits per second instead of the usual 64 kilobits. This allows a single circuit to carry 48 or 96 conversations simultaneously.

The user is allowed to select whatever type of

multiplexing equipment is desired to funnel traffic into the T-Carrier line. The ADPCM multiplexors, or the continuously variable slope delta (CVSD) modulation multiplexors can provide great advantages when setting up a combined voice/data network around an ACD center. Rather than running individual trunks or FX circuits to a given part of the country, it is now more economical to run a T-Carrier circuit into the economic center of your regional traffic, install a voice compression and data switching multiplexor, and then network intrastate WATS and FX, tielines, and data circuits off the end of the multiplexor.

This configuration not only lowers the cost of the transmission facilities into each region, it also allows the center manager to provide an FX network and cover a wider geographic spread for less cost rather than simply dropping twenty circuits into one area of a metropolitan district.

There are a great many manufacturers of this type of multiplexing equipment and some of the more sophisticated versions hitting the market will soon look like the current time division multiple access demand assignment techniques in which the 1.544 megabits of digital bandwidth is viewed as a resource pool; any activity which is requesting transmission capacity will draw from this pool as needed rather than assigning fixed amounts of capacity which may not be carrying traffic during any given second. These techniques will greatly reduce the cost of networking calls into an ACD.

TRANSMISSION ENHANCEMENTS

In addition to these offerings, there are a variety of new services available from the specialized common carriers. These services can provide significant savings over the circuit cost formerly experienced with Bell. Although these carriers are limited in their geography at the moment, the cost savings are significant for circuits between most major cities.

It is sometimes economical to install a private microwave system for short hops. The Los Angeles Times and IBM, for instance, are both using private microwave hops in the place of leased circuits and are saving substantial sums. This type of system is, perhaps, more practical for the sophisticated user.

As microwave systems become more reliable and less expensive, they will offer considerable savings to a complete spectrum of users. The payback period on line

of site microwave installations with hops under ten miles can be less than one year.

There are other changes in service offerings which will occur over the next few years and should have a significant impact on the communication costs for ACD centers.

The two major offerings currently in development are the Software Defined Network (SDN) and the Integrated Services Digital Network (ISDN). These two services really capsulize AT&T's basic transmission marketing plan for the next five years. This marketing plan appears to be divided into two parts:

1. Capture the major corporate accounts through significant discounts equal to the cost advantages of private networks.

2. Increase the revenue per call from smaller users to make up the discounts given to the large users.

An SDN system will allow a major account (for example, a customer with more than $25 million in annual billing) to bypass the local telephone company and connect each corporate location nationwide directly to AT&T's point-of-presence switch. All of the traffic from each corporate location will then be routed over AT&T's backbone network on-net to another corporate location or with tail-end hop-off at the distant end to non-corporate locations. The key to this arrangement is that all of the corporation's traffic will be collected, routed, and billed as if it occurred over a single dedicated network at substantial discounts.

The ISDN is a code-word for a much larger strategy that will involve reshaping AT&T's entire network to allow greater interconnection and switching of services while at the same time increasing the intelligence of the network. This change will alter AT&T's entire network to make it look much like the original concept for ACS (a.k.a. Net One, Net 1000, Enhanced Network Services) with the addition of voice switching services. This network evolution will also mean the demise of private line services in general with charges on a per message basis or per time basis just as is currently done in ordinary long distance.

Managers of small centers must be aware of these changes and prepare to make alliances with other carriers or larger users to insure an economical flow of calls.

Given this wide range of alternatives in circuit selection, the traffic volumes on each circuit, the different methods for measuring this volume, and the applicable service levels must still be understood.

TRUNK STATISTICS

The important trunk statistics cover a slightly different range than the staffing and call-handling statistics. The manager should be aware of the various ways these statistics can be calculated and also be aware of the implications of the various statistics.

The single most critical factor is the percentage of time that all trunks were busy carrying telephone traffic. This figure is included in the trunk reports of nearly all the ACD vendors.

The percentage that all trunks were busy is simply a comparison between the total amount of time that trunks were assigned and the total amount of time that every trunk in the system or trunk group was simultaneously being used to carry telephone traffic. For example, consider ten trunks in a group that were assigned for 1800 seconds apiece during a given half hour. For 1200 seconds of this half hour--scattered throughout the half hour--all ten of these trunks were simultaneously carrying conversations. This would mean that there were 10 x 1800 seconds of assigned time. To find the percentage that all trunks were busy, the 1200 seconds of simultaneous call-handling are divided by 18,000 to get a percentage all trunks busy figure of seven percent. This figure indicates that for seven percent of the time in that half hour, people who tried to call the ACD center would receive a busy tone for their efforts. They would not be able to reach a trunk to carry their call because all trunks would be occupied with traffic.

This calculation can also be done using the erlangs as a measure of offered traffic or CCS as a measure of offered traffic. The crucial thing is not so much this seven percent figure as calculating how many calls were blocked from trying to reach the ACD. In other words, how many calls would have reached your center if there were enough trunks for everyone all of the time? In relation to this, how many trunks would be needed so no calls were blocked and all calls could reach the ACD?

If a group of ten trunks is completely blocked seven percent of the reporting period, the Erlang B table indicates that the group was carrying a load of about 6.75 erlangs. Assuming that the average holding

time of a call was 180 seconds, this would mean that group was offered seventy-two calls, carried sixty-seven, and lost five calls in a half-hour period. From this information an economic analysis can be carried through on these five lost calls, and a determination made as to whether the cost of the additional lines to capture those calls is worth more than the revenue lost by allowing the calls to be blocked.

The seven percent service level is less important than the potential revenue that can be derived from any given grade of service. Looking at the Erlang B table, the addition of three trunks will drop the loss probability to around one percent. Is the price of three additional trunks worth capturing four more of those lost calls? That decision will have to be made by the manager once the relevant trunk costs have been calculated.

A few other measures of the trunking efficiency can be gathered from additional report fields that show the number of calls each trunk carried, the average length of time that trunks were seized for calls, the number of calls offered and abandoned on the trunks, and the average amount of time that a set of trunks within a group was carrying traffic.

The calls offered and abandoned are straightforward counts, similar to the counts for the agents at the gate. These calls were recognized, received answer supervision from the ACD, held for some period, and were either answered or abandoned.

The number of calls carried, then, is the offered calls minus the abandoned calls. These are all the calls recognized by the ACD as valid calls, seized and connected to the ACD queues, which remained waiting on the phone until answered by an agent.

The average trunk utilization time is another way of breaking down the statistics for total traffic-handling capacity of the ACD's trunking assignments.

The percentage of time that all trunks were busy gives a good indication as to when the blockage of traffic into the switch is exceeding the service level parameters deemed desirable by the ACD manager. The average trunk utilization time is particularly useful for showing the relationship between the amount of time that the trunk is carrying traffic, on the average, and the type of blockage that will appear given various levels of trunk usage.

Within the trunking statistics themselves, it is important for the ACD manager to have a logical arrangement of trunks into trunk groups for reporting purposes. The information groups in the ACD reports can be used to split each bundle of trunks into distinct groups comprised of trunks with some economic or functional similarity, such as WATS trunks, FX trunks, OPX trunks, or tie lines, to obtain the load that each set of trunks is carrying. This will facilitate the ongoing analysis for the best mix of trunks and blockage levels the manager will allow.

This blocking factor must be considered with the number of agents and the average handling time of the agents for each type of call. Predicting trunks for P(5) will be unrealistic if the swing in average handling times is not taken into account. Any delay on the agent side will increase the occupancy on the trunks. Since the trunks are working with a delay queue, their characteristics will model the Erlang B assumptions for the amount of traffic that can be carried, except that the Erlang C conditions of queuing will cause the trunks to block more traffic when staffing levels are low.

DEFINING INTRAFLOW PARAMETERS

There are several different types of intraflow available in the electronic ACD's. Intraflow allows the ACD to shift calls between gates if the call cannot be immediately answered at a primary assignment. This should not be confused with what is variously called overflow, interflow, load-balancing, or diversion. All of these terms refer to the distribution of calls between several different ACD's. Intraflow only applies to calls which are routed within the ACD itself.

There are two basic types of intraflow being offered. The Rockwell ACD provides immediate intraflow with intelligent queue routines. This means that a call entering the Rockwell ACD will be immediately assigned to a primary agent, a secondary agent, or a tertiary agent (in that order), and if none of these are available, the call will be placed in a delay queue to wait for an available agent.

The Teknekron, Rolm, AT&T, Northern Telcom, and Wescom ACD's all have queuing routines which determine the routing of a call once it is recognized by the ACD. These vendors provide a multi-part decision routine which allows a call to, for instance: First, look for a primary agent; Second, connect to a music

source; Third, look for a secondary agent; Fourth, connect to a delay announcement; Fifth, look for another gate, etc. A quite sophisticated call-handling sequence can be programmed by the user into these queuing routines.

Whatever method is used, the justification for intraflow call-handling is that the apparent size of the agent group connected to any given trunk group can be increased. The chapter on traffic engineering pointed out that large groups answer calls more efficiently than small groups. With intraflow, the incoming traffic can be spread out over a larger group. The actual implementation of the intraflow routines will be specific to individual ACD applications.

NETWORK CONFIGURATION PARAMETERS

The multi-node ACD's are fascinating and complex creations. These systems are among the most sophisticated communications networks in operation and make full use of combined PABX, ACD, and tandem operations with satellite, fiber optic, specialized common carrier, microwave, and private circuits carrying the traffic. These large ACD networks are certainly not easy to manage, but they also provide considerable economies of scale.

All of the major electronic ACD's can be used in some type of tandem routing scheme or load-balancing arrangement. There are a great many ACD sites which fail to take advantage of the devices' full power. The modern ACD's can be run like a WATSBOX^{R} or a least-cost routing system. Any system which will accept digits from a tie line can be used to route PABX or Centrex calls onto the public network or through a private network.

The ACD's routing packages can also be used to limit access to the network. The reports which the ACD generates on its own calls can be used to keep track of calls which are routed through it. There is an enormous range of possibilities for these machines. However, the typical application for multi-node ACD's is still load-balancing.

Although load-balancing does not exploit the full potential of the ACD, it is a function which is important and useful. In this function, several ACD's are tied together through dedicated four-wire voice circuits, intermachine trunks, or T-Carrier. When one ACD is closed or when the load on one becomes excessive,

the traffic is sent to the next switch.

This procedure is handled in a variety of ways, just as in the case of intraflow. Some ACD's use a delay dependent overflow from the first gate in the system. When the delay queue in the first gate (which must be a designated interflow gate) reaches a certain level, calls are sent to the next ACD. The receiving ACD does not engage in any intelligent signalling with the sending ACD in this case.

Other vendors, Rockwell International for example, use a signalling method that is very much like common channel interoffice signalling (CCIS). This type of signalling sends a query ahead of the call and asks the distant switch if it can accept any traffic. If this distant switch says yes, the call is sent--otherwise it is dropped into queue at the first ACD node. This kind of intelligent signalling makes more efficient use of the network. The ACD's with queuing routines use that programmed pattern to determine if calls should be sent to a distant ACD.

These systems can provide economies for ACD networks which cross time zones. Additional hours of service can be offered at some ACD's, or centers can be closed during light traffic hours while additional calls are handled more efficiently at a more active switch. The per minute cost of the IMT's (tie lines between ACD's) is extremely low, given the proper volume of traffic. The savings in staff costs can be very attractive. It is useful when involved with a network of this sort to have a night service feature or the ability to close a center by individual gates. This allows for a progressive closing of the system as traffic thins out for the whole center and obviates the requirement that everything be shut off at once.

These systems raise two very large problems.

1. There are seldom any organized ways to budget for the interflow of calls.

2. The total traffic load to be shared is difficult to predict.

The budgeting problem can be solved by the implementation of a network control center with the proper administrative personnel. A network control center collects all the traffic statistics for each node and insures that each center is credited with traffic handled for other nodes. The network control center also provides a central point for diagnostic efforts and routing management.

The traffic engineering problem is one that can be solved by simulation routines or practical experience. The mathematics required to actually solve equations for the traffic flow is unmanageable. A simulation technique will do a much more accurate job of predicting the cost savings and the traffic patterns in a multi-node ACD network.

To be effective, load-balancing systems should be implemented one step at a time and then allowed to run. Incremental implementation implies that the timing parameters used to send and receive calls should be progressively raised or lowered until the proper traffic flow is reached. Once a flow is established, the machine should be allowed to work uninterruptedly. The flow of traffic cannot be predicted on a minute-by-minute basis, and the load-balancing circuits must be turned on all the time to realize any economies from the system.

An additional tool which enables ACD centers to route calls is the Enhanced 800 service from AT&T. This service allows calls to be routed between centers based on the originating area code, the time of day, and the day of the week. Managers may even order a terminal for their center which allows changes to be ordered immediately with a service order. Enhanced 800 service provides a very useful facility for load-balancing and disaster recovery.

CHAPTER SIXTEEN

DEFINING STAFFING PARAMETERS

The critical issues in staffing stem from the service level and the differences between the expected agent productivity versus the actual work volume.

It is necessary to derive an assigned agents number that will, theoretically, handle the offered traffic and then predict the actual volume of offered traffic that the assigned agents will answer. This assigned agents number can be generated from historical data or from the Erlang C traffic formulas. Over a period of time, the manager may know that the agents can handle sixteen calls per half-hour or twenty calls per half-hour and will use this figure to forecast staffing.

If there are considerable variations in the traffic pattern which prevent this type of analysis, the Erlang C formula will provide a predicted value that will usually be high. The manager will have to experiment in each situation and find a correction factor for the Erlang C predictions. Either the tables or the formula can be used in this prediction.

If the manager expects ten erlangs of traffic during any given half-hour period and wants to insure that no more than twenty percent of the callers are delayed in the queue, then reading from the Erlang C table, fourteen agents should be assigned during the half-hour. Assuming an average handling time of 180 seconds, this would mean a delay on delayed calls of approximately 180/(14-10) or forty-five seconds. The average delay on all of the calls would then be .1741 X ((180)/(14-10)) or 7.8 seconds. These two measures indicate that, in common terms, eighty-three percent of the calls would be answered in eight seconds or less. This is an acceptale level of service for an ACD gate, but would have to be adjusted depending on the revenue-maximization point.

There is a great deal of slippage between the agents who are assigned at the management level and the calls that are handled at the operational level. These areas of slippage are the important statistics to consider when managing the ACD center.

One of the most basic types of slippage in the

agent staffing predictions is that not all the agents will appear on a given day. Due to any number of personal foibles and misfortunes, some predictable number of agents will not appear at their consoles at the assigned times. The ACD manager should chart the percentage of agents who appear against the number of agents assigned until a reasonable trend appears which will accurately predict the number of agents needed in practice. Of course, there are many things that management and personnel can do when operating together in this area.

All of these elements will be covered in more detail in the chapter on staffing, but it is prudent to remember that pay scales, turnover rates, sicknesses, working environment, management backbone, and the watchfulness of the supervisor crew are all critical determinants in maintaining adequate staffing levels.

Delving a little deeper into staffing considerations, it is necessary to consider the definition and content of some staffing measures. The positions assigned is a management decision. The actual positions manned depend on the agents themselves. The average positions manned is a more accurate count of the real staffing levels because it takes into account the amount of time that the agents are actually plugged into the console (or signed into the consoles in the case of the Agent Performance packages for Rockwell International, IBM-Rolm, Teknekron, and Northern Telecom).

Today's agent consoles have a sensor that will signal the computer when the agent has the headset plugged in. This allows the call processor to cease sending calls to a console with no agent present and also signals the Administrative Data System that it should count this time against the agent as unplugged time. The average positions manned figure is the total plugged-in time at the console divided by the number of seconds in the reporting period. For instance, if one agent is plugged in at the console for 1700 seconds during a half-hour period, this means that:

$$\frac{\text{1700 seconds of plugged-in time}}{\text{1800 seconds in reporting period}}$$

Equals .94 agents manned during that period.

Generally, the agents should be allowed some percentage of time away from the console that is equal to their total allocated break time, plus measured time required for research and reporting to supervisor, plus an increment of slack time (usually 1 to 5 percent) for

those odd moments when they're sharpening a pencil or getting a drink of water. This is an area management should pay attention to, but not get so stuffy as to annoy everyone.

There are some additional measures beyond the average positions manned that are essential. On some of the ACD systems, the average positions manned is broken down into the primary positions manned and the secondary positions manned. These measures are associated with the primary and secondary gate assignments that agents can be given within all of the digital ACD's on the market.

This works as explained in the following example. The airlines typically have one gate set aside for their very high-dollar acounts; for example, a large corporation with which they have a service agreement or a major travel agency. This high-dollar gate will typically offer only 30 or 40 percent of the total call volume to the ACD, but those calls account for 70 or 80 percent of the total dollar volume in business generated through the ACD. Obviously, the ACD manager is inclined to provide such customers the speediest assistance and most efficient handling. A typical solution in these cases, where manning may not be high enough to handle 100 percent of this business with little or no delay, is to assign auxiliary agents through the use of secondary assignments. This means that the agents sitting in the General Sales gate can all be given secondary assignments to the High-Dollar gate. If they are not handling primary calls, they will answer calls for their secondary assignment.

Conversely, if there is a gate with very little traffic, say the Admirals Club, then instead of assigning primary agents to that gate--where they will handle very few calls--all of these agents can be given primary assignments in the High-Dollar gate and also be given secondary assignments in the Admirals Club gate. When they are not handling calls at the High-Dollar gate (which will be purposely overstaffed), they will be available to handle calls for their secondary assignment. The ACD provides the breakdown of traffic to these primary and secondary assignments so the manager knows where the agents are spending their time.

These are the various elements involved with the actual staffing numbers. Within these statistics are some finer breakdowns as to the manner in which the agents spend their time. The three most important are the "occupancy," the "availability," and the "auxiliary work time."

The occupancy is measured a variety of ways within different reporting systems and it is best for the manager to become thoroughly familiar with the meaning of this field in the reports associated with each system. Occupancy is the comparison between the amount of time the agent was available to handle calls and the amount of time the agent was unavailable to handle calls. This percentage shows the time during which the agent was plugged in and taking calls at the console or in the after-call work state.

Availability is another statistic that is idiosyncratic to each system and should be analyzed as such. Generally, this field indicates the percentage of plugged-in time that the agent was available, ready, and able to handle additional calls. In this sense, it is a measure of the activity on the system. If availability is extremely high, it means that the agent was underutilized and the system is operating at less than peak capacity. The availability figure should be correlated with the designated service level for the system. Of course, as the chapter on economic analysis pointed out, there will be many situations where the point of maximum revenue for the ACD will be a point of minimum traffic-carrying efficiency for the ACD. In an ACD with a low ratio of labor costs to call revenues, it will be economical to staff at very high levels. This will mean that each agent is doing less, thereby lowering the traffic efficiency, but that the overall system is generating more revenue, thereby increasing the economic efficiency.

Auxiliary work time is a special key that keeps track of time spent on non-ACD functions. For instance, if the manager has agents doing invoicing or ticketing when they are not handling calls, they may press the auxiliary work key and continue with this activity while it is logged in a category distinct from the communications measurements found in the other ACD reporting fields.

The methods discussed above are the common and most important standards by which the performance of agents is measured. It cannot be overemphasized that the manager should be aware of what each standard means and what it is measuring. If an agent performance report is available, this will greatly simplify the measurement of individual agents.

These measures all quantify the physical presence of the agent as perceived by the customer. This information is usually gathered with measures associated with the gate level call-handling process. These measures are the average handling time, the

average talking time, the average after-call work time, and the average outcall time. While more meaningful at the gate level, these can be important factors for general staffing considerations.

Most ACD's are not managed in relation to these efficiency factors. It is generally felt that the call-handling process cannot be manipulated or streamlined. In the case of after-call work time, this is certainly not accurate. Much can be done to improve the data entry process for the agents and lessen the time expended. Reducing the average talking time is a more difficult problem. There is a tendency to say that a conversation cannot be rushed. The conversation should not be rushed, but it should be efficient. The average talking time should not be considered without reference to the average revenue per call (as a longer conversation may produce a larger sale), but the agents should be trained to accomplish the maximum good in the minimum time. The manager should not be in the position of accepting a given talking time because it always appears on the reports. This interval can be managed and thereby decreased or increased.

The most intellingent ACD users in the staffing area, when considering a non-revenue system, are the telephone companies. Every call is quick and efficient, producing the maximum flow of information in the shortest possible time. The telephone companies also do an excellent job of forecasting and staffing the ACD to produce the minimum cost within their stated service level objectives. There are additional measures of agent productivity which Bell developed for their Force Administrative Data System. These measures are useful in determining the effectiveness of the manager's own staff forecasts. There are three which should be useful in any ACD environment:

1. Schedule Efficiency Ratio
2. Team Efficiency Ratio
3. Efficiency Measurement Ratio

The Schedule Efficiency Ratio measures the accuracy of a revised staffing schedule. This ratio compares the predicted number of agents required to the average positions manned during the reporting period (Required Positions/Average Positions).

The Team Efficiency Ratio measures the accuracy of the forecast work time. This ratio compares the standard work time (which is the length of time a normal person would be expected to take on a given call) with the actual work time found in the reports (Standard Work Time/Actual Work Time).

The Efficiency Measurement Ratio looks at the accuracy of the predictions for the entire ACD. This ratio compares the standard positions (the number of people who normally would be required to handle a given workload) with the average positions staffed (Standard Positions/Average Positions).

When considering the problem of staffing, the ACD manager should also be aware of the audio response units and voice recognition units which are entering the market. These machines are already installed in a number of ACD's and provide a rudimentary answering function that can serve as a replacement for human labor in specific applications. Once more sophisticated voice recognition units are produced, it may be possible to replace a great percentage of the agent staff. Dialog, Periphonics, Votran, and other vendors are producing units which either perform a function in response to the entry of keyed touch-tone digits or actually recognize and respond to a human voice.

There is every indication of a significant breakthrough in audio response and voice recognition equipment during the 1980's. AT&T, IBM, and other smaller companies are spending sizable R&D sums to be the first to produce a voice-activated typewriter. These machines will be able to accept continuous dictation from any speaker and translate that speech into typed output or command responses with a 97% or better accuracy rate.

Audio response equipment is achieving widespread acceptance by the calling public. Many airlines and credit card companies are using this equipment to accept requests from merchants and consumers.

The economics of these systems are not difficult to appreciate. A typical audio response system requires a capital expenditure of $4,000 to $6,000 per line. That line will be able to take traffic 24 hours a day, 7 days a week. Human operators may cost $5.00 per hour. After fifty days the audio response system has recovered the capital expense. Voice recognition systems will be much more expensive and still achieve significant savings over the $31,200 it would cost to staff one line with one person over a three-year period.

PART V

MANAGING THE EFFICIENT ACD

DO NOT REPRODUCE

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CHAPTER SEVENTEEN

PHYSICAL LAYOUT

The configuration and design of the physical plant for an ACD communications center has an enormous impact on the efficiency of the center and the work habits of the operating staff. Much of what should be done in this area is a matter of common sense. The difficulty is that not many corporations have the flexibility or the economic resources available to rebuild their communications operation around the requirements of an ACD.

For a small center, and this might involve only five to ten agents, little needs to be done beyond providing adequate working space in an office. The primary consideration is to maintain some proximity between the agents and the operating equipment in order to stay within vendor specifications. This type of preliminary site layout will usually be covered by the vendor or a subcontracted architect who understands the vendor's equipment.

For the larger sites, ranging from fifty to six hundred agents, there should be considerable attention to detail in the layout of the communications center. A thorough site survey is necessary to insure that the following requirements for a computer environments are within the specifications: adequate air conditioning, floor loading requirements, additional power supplies, underfloor cabling, etc. Again, the vendor and the contractor will usually insure that these arrangements are acceptable. Many companies buying an ACD of this size will already have data processing facilities and understand the need for special care around this type of equipment.

Another area which requires some foresight and careful planning on the part of the communications manager is the layout of agent equipment stations. There are some beautiful communications centers with pleasant working conditions and efficient system designs. United Airlines and PSA Airlines are justifiably proud of their reservations centers. These offices are models of quiet productivity and operational efficiency. There are other centers in which the ACD consoles and information books were dropped

onto the old desks from the secretarial pool, and the communications center was instantly in business--after a fashion.

An ACD center can be a very noisy and hectic business area. With two hundred people conducting simultaneous conversations in one room, the situation becomes nerve-wracking. There is no good reason to maintain an ACD center in a large area with no partitions and row upon row of desks where everyone talks just a little louder to overcome the voice of the next person who is also talking just a little louder.

The communications center can be organized along the lines diagrammed in Figures V-1 and V-2. Each pinwheel or cubicle area should have one team of agents. Each area is then assigned one supervisor, with the system supervisor in a convenient location near the center or periphery of the office. Carpeting on the floors and sound insulation tiles in the ceilings are a must. The walls between agents' stations should be low enough so that a supervisor can see over them when standing, but high enough that seated agents cannot see into other areas. A convenient lounge and rest area should be located adjacent to the main area.

Each agent station should be equipped with the telephone console, an information set (whether this be printed forms or a CRT data screen), and any other essentials. There should be a dual jack on every agent station allowing supervisors to plug into conversations while they are walking through the team's area.

If the center is constructed with large windows, there should be some shading, either from a sun-screen in the glass or by an overhang. The newer consoles are constructed with LED displays and illumination lamps. These bulbs are easily washed out by reflected glare or direct sunlight.

The center should also be constructed around a reasonable estimate of the company's growth patterns. Either construct the center with floor space for the maximum capacity of the current ACD equipment or for the projected agent requirements over the life of the office area. The additional space can be used for other purposes until the center's growth reclaims the area.

The room should be organized with consideration given to transitions between the night service agents and the other shifts. This can be accomplished either by staggering the arrival and departure times of various teams or by assigning an adjacent set of consoles and cubicles to the incoming shifts.

86E70*4230060

A TYPICAL AGENT NUMBERING SEQUENCE FOR 4 GATES

Lead Supervisor



Group Supervisor

1029	1030	1031	1032
1025	1026	1027	1028
1021	1022	1023	1024
1017	1018	1019	1020
1013	1014	1015	1016
1009	1010	1011	1012
1005	1006	1007	1008
1001	1002	1003	1004

Gate One

Group Supervisor

1124	1123	1122	1121
1117	1118	1119	1120
1116	1115	1114	1113
1109	1110	1111	1112
1108	1107	1106	1105
1101	1102	1103	1104

Gate Two

Group Supervisor

1224	1223	1222	1221
1217	1218	1219	1220
1216	1215	1214	1213
1209	1210	1211	1212
1208	1207	1206	1205
1201	1202	1203	1204

Gate Three

Group Supervisor

1320	1319
1317	1318
1316	1315
1313	1314
1312	1311
1309	1310
1308	1307
1305	1306
1304	1303
1301	1302

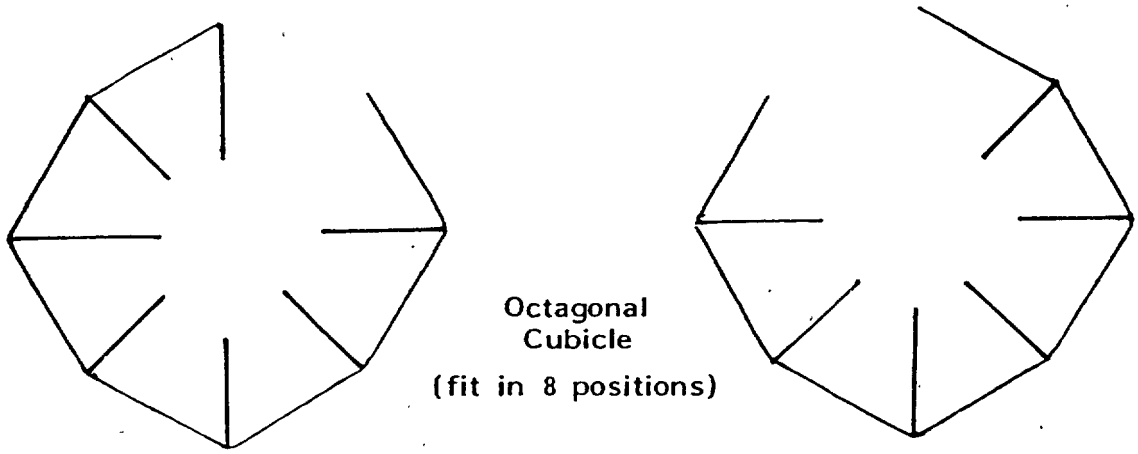
Gate Four

COMMUNICATIONS CENTER

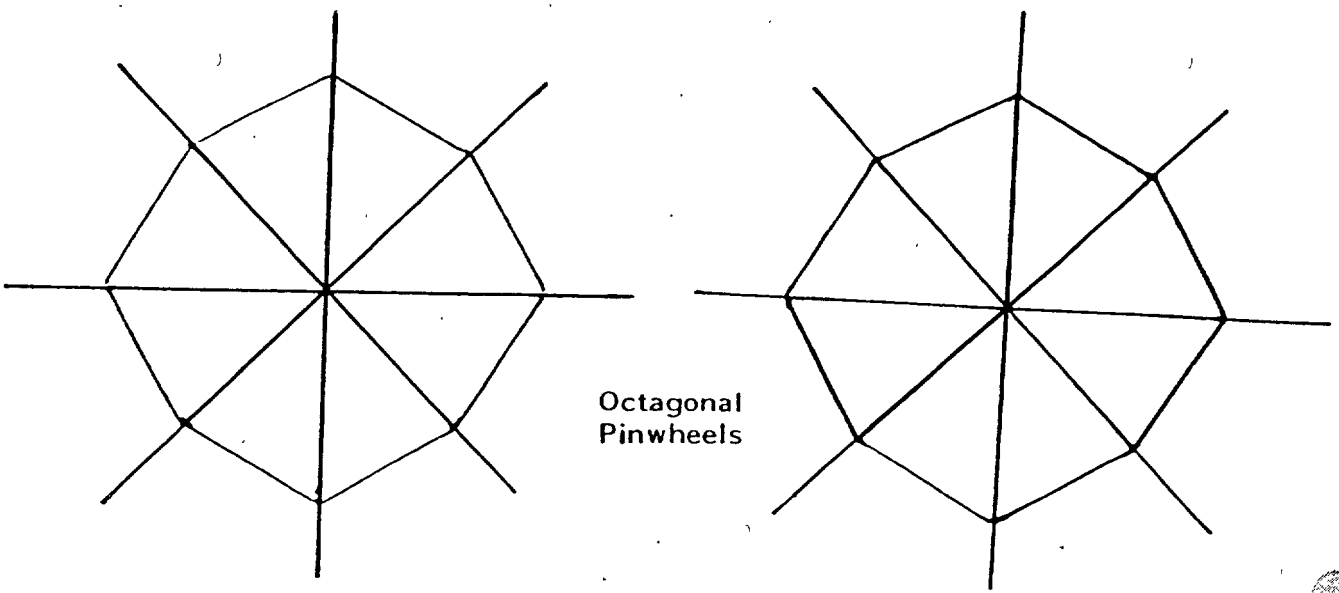
Master Supervisor Position



Main CRT & Main Printers



Octagonal Cubicle (fit in 8 positions)



Octagonal Pinwheels

Figure V-2

CHAPTER EIGHTEEN

STAFF ORGANIZATION

The communications staff may range from a one-person organization with shared responsibilities in other departments to a full-sized communications department with independent management, analysts, and an autonomous budget.

The key to a successful communications management team is power. The management organization must maintain an independent budget and be fully aware of its responsibilities. There must be some effort to allocate costs based on each department's use of the communications service. A large organization will require a central planning group to make decisions for the entire communications area. Typically this will mean a merger between the data processing communications staff and the voice communications staff. This joint communications department should then report directly to the top management of the profit center --not to an intermediary with no knowledge or concern for the communications job.

In this larger entity of the communications/EDP department will be a management staff responsible for the operation of the ACD. Since the modern ACD's are typically a combination ACD, PABX, and tandem switch, this management staff, in the larger departments, will usually have a great deal of influence on the overall communications decisions. In a system with multi-node ACD's tied together by a private tandem network, or utilizing load-balancing tie lines for economy of scale throughout the ACD network, the profit center ACD communications staff will also work with the corporate communications staff on decisions involving the network as a whole.

A familiar arrangement within the airline industry is to assign operation of the ACD to the reservations management staff, then divide the authority for the actual ACD equipment between this department and a facilities group. The problem with this arrangement is the absence of a centralized budgeting and planning function for the whole network and lack of direct responsibility for the overall operation and management of the ACD.

Sometimes users have poorly organized communications departments. Occasionally, the person who orders the ACD will not talk to the person who installs the ACD and that person will not talk to the people who actually run the ACD. Centralized authority is the only method that will sustain effective day-to-day operation, as well as the long-range planning needed to maintain the ACD's efficient service level.

An ACD center requires specialized personnel. If the department is large enough, an effective ACD staff will consist of:

1. General Manager
2. Communications Manager
3. Staffing Group
4. Trunking Group
5. System Supervisor
6. Team Supervisors
7. Equipment and Maintenance Group
8. Support Group of Analysts
9. Training Staff
10. Quality Assurance Group

If the ACD is part of a network, additonal personnel will be required to control the network and maintain circuit quality on the lines.

The general manager is responsible for everything that happens, and doesn't happen, in the ACD center. This person reports to the communications department or directly to the profit center director. The general manager relies on staff assistants to prepare the final budgets and make recommendations on equipment purchases and general system goals. This individual could also work with the corporate communications staff responsible for network concerns.

The communications manager is directly responsible for day-to-day operation and maintenance of the ACD center. In smaller systems the communications manager's tasks are combined with the system supervisor's responsibilities. The operating personnel in the ACD organization report directly to the communications manager. At this level, the communications manager typically interacts with the system supervisors, the group supervisors, the staffing and trunking groups, the training group, and the people responsible for the equipment room.

The staffing group is often, in smaller systems, a shared function. For larger ACD's the staffing group is responsible for hiring, firing, assignment, and scheduling of the agent staff. The training group and

the quality assurance group, as well as the system supervisor and the group supervisors, work with the staffing group. The staffing group, along with the communications manager, prepares the reports required for upper management and determines the staffing levels necessary to meet the service objectives. This group should be competent analysts themselves, or have priority access to analysts, in order to make staffing decisions. In a smaller system, the work done by this group can be divided among the communications manager, the system supervisor, and the group supervisors.

The trunking group performs tasks similar to those of the staffing group. However, members of this group work more directly with the analysts and equipment personnel than the supervisors--although they should obtain line trouble reports from the group or system supervisors. There should be discussion between the trunking and staffing analysts, as the level of staffing within a particular gate serving any given trunk group will significantly affect the level of blocking against that trunk group. In a smaller system this function can be assumed by the communications manager. The trunking group also consults with the corporate communications staff about load-balancing trunks and network tandem trunks.

The system supervisor is usually in charge of the direct, real-time operation of the ACD. The system supervisor may share these responsibilities with the communications manager. The system supervisor usually sits in a master control room, or at least has access to the system configuration control CRT, and monitors the overall call-handling capacity of the ACD. This person should have authority to move, add, or drop agents and trunks within the ACD, as well as all other configuration commands (with the exception of internodal network commands), in order to effectively balance the staffing of the ACD against the traffic demands of the various gates. The system supervisor is directly responsible for maintaining the established service levels throughout the daily operation of the ACD.

Team supervisors are directly responsible for their group of ten to forty agents. The team supervisors monitor the activity of these agents and handle assistance calls or trouble calls that are beyond the capability or training of their group members. Team supervisors assume responsibility for the quality of the telephone service within their team. These supervisors are also responsible for performance evaluations and must have the power to make recommendations on firing and promotion.

The team supervisors will not usually handle calls themselves; they provide an assistance function and can be given report analysis duties or staffing functions in a smaller center. The quality assurance program will often be assigned to the team supervisors in a small ACD. If the center is small enough, the system supervisor might serve as a replacement for the team supervisors, but generally this results in too much to do with too little control.

An equipment maintenance group is optional. Most vendors provide either a site engineer for the customer or a service center within a reasonable distance. However, many ACD centers handle their own equipment maintenance and rely on the vendor for software maintenance only. Any company with a data processing shop will usually have personnel qualified to maintain the electronic switches now on the market. ACD centers with personnel who perform their own maintenance seem to understand their equipment better at all levels and show greater imagination in the application of the switch. The cost savings of self-maintenance can be substantial. This is an option worth considering.

There is a need for highly skilled professionals among the staff of analysts. The quantitative and analytical skills required to make effective financial decisions are quite advanced. The analysts group operates as a central pool of information available for the use of anyone in the communications department. This system works much like the Library of Congress does in relation to the Congress. The analysts are part of an independent service which provides a library of information and technical skills that are loaned to other departments. In this capacity the analysts are responsible for providing the information other groups need to make decisions. Within the analysts staff there would be people specializing in financial analysis, tariff information, trunking, and forecasting. This group could keep up to date in technological advances and provide a central file of software changes and system features of the present ACD.

The training group is usually a staff of only one or two people, even for the largest organizations. However, the importance of these individuals cannot be overemphasized. The ACD world is just like that of the PABX--there is a mind-boggling array of special features and capabilities that no one uses because no one can remember them. The training department is primarily responsible for training new agents, but it should also work with the system and group supervisors in an auxiliary training program on a continuing basis.

The quality assurance group is a separate function only in regulated environments. ACD centers required to report their service levels to a Public Utility Commission usually must maintain a quality assurance group which monitors the agent staff on a regualr basis. In other ACD centers this function is taken over by the system supervisor or the group supervisor.

The ACD manager must consider staffing from a number of different perspectives. In the workplace, fear is often the simplest motivator. However, generous encouragement coupled with opportunities for career advancement are better motivators for the highly skilled and intelligent workers generally found in the ACD environment.

There are two personnel philosophies in operation among communications managers. One presumes that agents are merely intelligent typewriters connected to an audio response mechanism. The other believes agents to be reasoning individuals with a sincere interest in their performance. The two groups hire differently, pay differently, and expect different things. Both managerial types get people to work for them, lots of people, and they can run effective centers. The second group, however, also employs people who enjoy working for them. It's a question of economics or aesthetics: whether one is more effective than the other. With regard to ACD agents, that study has yet to be done.

There is a tendency to view agents as a herd of interchangeable parts. When that tendency becomes overt, the manager finds a union steward sitting next to the system supervisor. An ACD should be run at peak efficiency, but the long-range goals of an efficient manager must also include the well-being of the agent force.

There are several important criteria in hiring, whatever your management philosophy. Some of these criteria will be determined by the location and configuration of the ACD. Hopefully, the site location was chosen not only for convenience, but because the surrounding locale can supply a large pool of educated workers. Most of the tasks performed in an ACD environment require people who can think on their feet, deal with irate customers, understand a complex database, and promote a product or service.

There are ACD applications, such as credit card authorization and record sales, which can operate at minimal labor standards. The complex tasks, however, will require very bright high school graduates or college graduates. If the ACD can be located in a

university town, so much the better. This is not to suggest that students are the best workers, but faculty wives and faculty husbands are often very good choices. There will also be a number of people with irregular schedules available for swing shifts and night duty.

A critical consideration in hiring is the union. If there is a union, it is best to be thoroughly familiar with its rules and regulations. The use of part-time help, temporary shifts, and emergency agents can be severely restricted if the union rules are misconstrued.

The costs of hiring and turnover are enormous, and anything which may lessen these costs should be examined. A careful record of employee profiles matched against the people who stay with the company and those who leave may uncover some clues to assist in the hiring process. Some people, for example, work at an agent console for three months and run screaming from the room; others settle in for a lifetime.

Many ACD centers, particularly in the airlines industry, require a grasp of detail which is beyond the average individual. Thorough screening can save the countless dollars lost when employees and job requirements are mismatched.

Firing procedures also are determined by job specifics. When a union is involved, employee dismissal must be conducted according to stringent regulations. In a non-union ACD center, there should be definite performance standards maintained. Any agent who cannot meet those performance standards after a reasonable training period, and retraining period, should be dismissed--provided there are replacements available. Many ACD centers establish minimum criteria by which to judge an agent's performance. If a certain work volume or sales volume is not maintained, these criteria should be used as the basis for dismissal.

All jobs don't require creative people, but your personnel department could be encouraged to be more innovative. Most personnel need not be hired according to outdated standards. An eager and interested pose during an interview doesn't always guarantee a dependable worker. Employ the reserved, but qualified applicant, add in a few misanthropes--you may be pleasantly surprised by the evolution of an efficient and conscientious work force.

CHAPTER NINETEEN

TRAINING

No one teaches as well as a teacher. There are definite tricks to the trade, as well as good and bad ways to present information. A teacher has to be accurate and informative, yet entertaining and stimulating. These skills are developed and enhanced by the experience of being a teacher. The moral here is that a former teacher can be a valuable addition to any training program.

Fortunately for the ACD manager, there are always good teachers who would like to get out of high school or college teaching. Because they are good teachers may be precisely why they would like to get out. When considering such an individual, see a sample of their work. Teachers, like entertainers, are usually comfortable with the requirement that they audition for a job. Any good school will require prospective teachers to present a class before a hiring decision is made. The personnel department and the ACD manager can establish the same requirement.

Once a good candidate is chosen, it is mandatory to send them through the vendor's training course. Every large communications company will offer a full range of standard and optional courses covering their equipment. The courses will teach participants the software, hardware, and operational features of the ACD. Members of the training department should take such courses every time a new software release is purchased, or whenever changes are made in the operational characteristics of the switch. Operating the ACD consoles and equipment is only one aspect of the training program, but it should be understood as completely as other elements.

The training program for phone representatives should be established in accordance with the complexity of the agent tasks. Some training courses can be completed within a week; one major airline developed a three-month training program for its agents which requires a college degree for entry.

The training course should be a three-stage program covering all aspects of the agent's job at increasing

levels of difficulty. Three stages are established to allow a progressive weeding out of unacceptable candidates. There is little point in allowing twenty-five poeple to sit through a five-week training program --only to flunk half of them at the end.

The first stage is a one-day session on the basic job description, center operation, and ACD performance goals. The trainees tour the center and are given a general orientation lecture about their job. At the end of this day, a test is administered covering the basic skills required of an effective agent. This provides an opportunity to fail those who passed the personnel screening without the requisite basic skills.

In the second stage, the trainees are taught the actual procedures required for their jobs. They become familiar with the communications equipment they are to use and the database CRT or information files. Drills are conducted which include pushing the buttons required to complete calls on mock consoles and working with the database files. The trainees are given time to observe and monitor seasoned agents performing the same tasks. A performance evaluation file is maintained on each agent and regular tests given to eliminate the ill-adapted.

The training department usually writes a programmed text which the trainees use as a guide and reference source in their jobs. The programmed text should spell out the job description and the objectives toward which trainees should strive. Competition and pressure are tremendous teaching aids--they should be applied in liberal doses in the classroom, along with generous encouragement and practical application.

Since the students will be actively performing a task once their training is complete, the second stage focuses on this task, and classroom exercises simulate that task as much as possible. Verbal presentation of physical procedures has almost no impact until trainees are allowed to perform the action themselves. Most of the larger ACD's offer a training position that simulates the functions of an agent or a supervisor. Students should spend time in this controlled environment until they are comfortable with the tasks required in the ACD center.

This second stage involves only those remaining trainees who have demonstrated their competency and will take a job within the center. This training can take place in the classroom or the ACD center. At this stage, the trainees should be competent enough to answer the telephone and assist with calls. It is

important to put trainees in a separate gate or statistical reporting group in order to evaluate them in relation to the established agent force.

The third stage provides advanced training and continued drills in the operation of the equipment, as well as additional instruction in techniques of salesmanship and effective service. Some ACD centers, such as credit card authorization services, will not need agents with sales training. For an ACD center selling a product or service, such training is essential. Many key phrases sound merely pleasant or neutral, yet may trigger a positive sales response.

In addition to the initial agent training, the training department should work with the supervisors to offer additional training to agents who are lagging behind accepted work standards. This should be done as unobtrusively as possible. If an agent is singled out for remedial training, it may be less embarrassing to leave the company than sit through the class. Some centers offer refresher courses on a regular basis and send all of their agents. This brings everyone up to date on company procedure and equipment changes. This is also a good time to reiterate the importance of consistency in the answering and call completion routine. Training programs can be extremely efficient tools throughout an agent's job cycle--not just in the first few weeks.

CHAPTER TWENTY

SUPERVISOR GROUPS AND AGENT TEAMS

The basic management unit in an ACD center is the agent team. An agent team consists of ten to forty agents, one to four lead agents, and a team supervisor.

The team supervisor is in charge of the day-to-day performance and real-time supervision of the ten to forty agents reporting to that supervisor. The number of agents in a team is determined by equipment and management limitations. For an ACD with relatively complex tasks, the ideal size is fifteen agents per supervisor. A system with few agent assistance calls and an uncomplicated task may have forty to sixty agents in a team. The maximum number of agents in a team is limited only by the number of positions which can be displayed on the team supervisor's CRT screen or lamp display. The supervisor can only manage as many as can be monitored. While systems vary, the CRT's in most ACD's will not allow the real-time display of activity states for more than fifty agents at one time. Since the supervisor performs quality assurance work, agent evaluation, and monitoring, in addition to the assistance function, there should be enough activity to keep teams of fifteen to twenty agents busy.

The team concept is used to maximize the performance of the ACD. The desire to perform well before one's peers is part of human nature--as is the tendency to get lost in the crowd. An ACD center organized so that the agents sit in a large, homogeneous mass may produce agents who suffer from alienation. Alienation in this case is the divorce of oneself from responsibility and a lack of identification with the task or role being performed. In a large group of agents, the feeling may arise that "someone else in the group will do it" and the individuals tend to coast. In a smaller team, there is a sense that "we" are doing it, and the wonders of peer pressure will soon be evident.

A great deal can be done to promote this team concept and its motivational effects. Physical layout of the agent consoles and work areas should reinforce the sense of a group working together. All the people within a team should work for the same gate, report to

the same supervisor, and be studied within the same statistical reporting group. Perhaps the most radical application of the team concept is to report on each individual team, as compared to other teams within the ACD. This will occur by itelf, but it is also possible to spot the performance levels of each team and encourage the resulting competition. One communications manager in the industry has obtained some interesting results through a more subtle approach. While casually strolling through the center, this manager "accidentally" drops the appropriate agent performance reports near the appropriate agent stations, confident of the ensuing scramble and increased efficiencies.

Within the team itself, an even more radical idea is to encourage the self-regulation of the unit. There are several ACD centers which have gone so far as to provide a pay differential between teams based on performance. The performance data on each individual within the team is also made available and the group is rated according to the average of all the individual performances.

The reporting systems of the Rockwell International Galaxy ACD, the Teknekron INFOSWITCH^{R}, and some others, allow the collection of statistics on individual agents, based on an identification number that agents key into their console. Under these conditions, the team members will exert considerable pressure to insure that all members of the team are working at capacity. Any members of the team who are bringing down the average for the group as a whole will be encouraged, not so subtly, to return for training, increase their performance level, or to leave.

The team concept is useful in all types of ACD centers. However, it should be recognized that it is most useful in a cost center rather than a revenue center. In a revenue center, there is an inclination to allow agents the maximum time on a call they feel is required. Their special training in sales techniques makes them competent to make this decision and generate additional revenue. In this situation, the competitive team concept would be counterproductive unless the evaluation was tied to revenue-generation rather than call-handling efficiency.

In a cost center, where each call and each additional second on a call is costing the company money, the competitive team concept is most advantageous because it drives handling times down and maintains maximum occupancy of the console.

When the teams are larger than twenty agents, it is

useful to appoint lead agents within the group who can provide secondary assistance and leadership functions as backup to the team supervisor. In cases where the team supervisor is off-duty or ill, the team leader would be capable of handling this position. Not only does the lead agent concept allow the manager to second-source the team supervisor, it also allows the other agents to recognize the opportunity for advancement. It is all too easy to forget the considerable management potential among the agent force, but the agents will not forget if they're forgotten.

There are good and bad assignments within the ACD, as well as prestigious and unattractive gates within the system. The manager should be aware of these distinctions and assign the better teams to the better areas. If the ACD is using union agents, union rules will govern the assignments. Union rules usually require that agents be allowed to bid for assignments based on their seniority.

In all of the sophisticated ACD's (Rockwell International Galaxy, Teknekron INFOSWITCH®, AT&T ACD, Northern Telcom SL-1, Rolm CBX-ACD, Wescom 580 ACD), the manager has the capability to set multiple gate assignments for the agent staff. This allows the manager to more effectively distribute the traffic load and provide for large group efficiency within a structure of clearly identified smaller groups.

Each agent is given a gate assignment which indicates the type of incoming traffic that agent will answer. The agents may be responsible for a given set of trunks, or a particular region, or a certain type of call. The initial gate assignment, the agent's "primary" assignment, is usually in the gate which handles the majority of the traffic that agent will be trained to answer. For instance, a bilingual agent might have a primary gate assignment in the International Travel group of an airline ACD. Since the agent's bilingual skills may not be needed all of the time, a "secondary" assignment to another gate may also be established. This secondary assignment would require the agent to assist with traffic from the general sales gate. If all of the agents who normally (and primarily) handle general sales calls were unavailable, then the call would be routed to the secondary agent in the International gate. The same procedure can be followed with tertiary assignments. This allows agents to back each other up from gate to gate and to handle overload or delay queues from other gates.

When establishing any type of crossover arrangement

between gates, it should be remembered that the proper database information and the proper training must be implemented. To be effective this procedure also requires some consideration of the economies made possible by the backup functions.

If a high-revenue gate with a small calling volume is used to back up a low-revenue gate with a high calling volume, there is some danger that the agents in the high-revenue gate will become overloaded with calls from the other gate and not be able to fulfill their more lucrative functions with the proper level of service. The assignments should be balanced by predicting the theoretical overload under different traffic conditions and then staffing in accordance with those predictions. It is usually preferable to fully staff the high-dollar gates with primary agents only and back up these agents with people from other gates. Agents from those gates with equal revenue per call can be used in a one-to-one backup arrangement.

Every ACD needs a monitoring and quality control function to insure that the objective service level identified in the reports is also a humane and conscientious service level during the actual telephone conversation. A great deal of the manager's job involves translating that telephone conversation into a series of numbers, charts, and budgets. But it is the human content of that conversation which helps bring customers back and enhances the public perception of an organization's quality.

In a large installation the quality control group is a separate team which continually monitors agent performance and sometimes the circuit quality. The quality control group makes recommendations on retraining, assistance, or adjustments in the call-handling procedure. The smaller ACD's will assign this function to the group supervisors, or it may be handled informally within a group of five to twenty agents.

There are legal difficulties associated with monitoring. The ACD manager should be aware of the local regulations in regard to this practice. In most cases, monitoring is allowed if it is done for training purposes only. Some areas do not allow monitoring in any form if the agent's identity or the identity of the calling customer is recorded.

Whoever does the monitoring, it should be done objectively and on a regular basis. One person, performing only the monitor function, can analyze the performance of each agent in a group of two hundred about once every two weeks. This assumes an average of

fifteen to twenty minutes listening to each agent, which would involve about four calls, and some time per week for reports and recommendations to the supervisors or the training department. Again, the analysis function should be as objective as possible. It is very easy to listen selectively and only hear what is expected.

A useful procedure is to combine the results of the monitor analysis with the ACD's printed reports for that time period. If the ACD has an agent performance reporting package, those reports should be examined for the monitor period. If the system does not provide this, the agent should be moved into a separate reporting group and statistics gathered during the monitor period. Each call should be ranked via a printed form that checks the main areas of the agents' responsiblities and training. In some centers this will be a very simple checklist, in others which expect their agents to also perform a sales function, this will be correspondingly complex. A sample form is printed below for a moderately complex monitoring function.

Reports of this type should be collected on each agent and used in the evaluation and review cycle. They should also be included in the agent's personal file. The ideal situation is to tie this quality control function into a CRT database that will allow the automatic production of an agent work profile and eliminate the extensive paperwork that the monitor function usually generates.

MONITOR
DATE_____

FEDERAL SERVICE MONITOR REPORT

Agent Phone #	Trunk ID	Gate	Team

Supervisor's Name_____
Agent's Name_____

	A	B	C	D	F	NA
QUALITY OF GREETING	___	___	___	___	___	___
AUTHORITY	___	___	___	___	___	___
KNOWLEDGE	___	___	___	___	___	___
HELPFULNESS	___	___	___	___	___	___
PROMPT ASSISTANCE REQUEST	___	___	___	___	___	___
SALES TRAITS	___	___	___	___	___	___
OFFERED ADDITIONAL SERVICES	___	___	___	___	___	___
SUGGESTED RENTAL CAR	___	___	___	___	___	___
SUGGESTED ACCOMODATIONS	___	___	___	___	___	___
ASKED FOR SERVICE AGAIN	___	___	___	___	___	___

REPORTING SYSTEM ANALYSIS

Average Handling Time_____
Average Talking Time_____
Average Work Time_____
Efficiency Ratio_____
Occupancy_____ Availability_____Average Call Rate_____
Attach Supporting Data

FEDERAL SERVICE ACD MONITOR REPORT

Recommendations:

____	Additional Training	Team
	Rank_____	_____
____	Supervisor Conference	
____	Commendation	System
	Rank_____	_____
____	Review	
____	Personnel Action	

Additional Comments:

PART VI

ADMINISTRATIVE DATA SYSTEMS

CHAPTER TWENTY-ONE

KEY REPORTING REQUIREMENTS

One of the principal reasons for installing a modern, computer-controlled ACD is the availability of a comprehensive administrative data reporting system. The reporting system illuminates a formerly obscure area and provides the manager with an X-ray of the call-handling process essential for effective management. The modern ACD's are no longer dependent on central office peg counts or scanning devices. The manager has a complete accounting of every activity in the ACD from the handling times of individual agents to the real-time status of individual trunks. There are cost accounting packages, forecasting packages, and trunking packages all designed to provide an ACD which handles more calls, with fewer agents, at a higher service level, and under complete management control.

Given the constraints imposed by the system size, its complexity, and the management philosophy, each communications department must choose a reporting package which fulfills the needs of the specific ACD application. Most of the ACD's on the market offer a wide range of standard and optional reporting packages which provide almost every conceivable level of detail and complexity. Many users also build their own software packages to provide different reports to supplement the vendor's data collection.

Each manager must determine what elements are critical to the effective management of the ACD and which can be foregone. However, there are some core reporting requirements that appear in the repertoire of each vendor, and these are required for any relatively complex ACD applications.

Every reporting system must examine:

1. Gate Statistics
2. Information Group Statistics
3. Trunk Capacities
4. Delayed Call Statistics

Within each of these categories, the various manufacturers provide different definitions and methods of displaying the data, but there are some similarities worth examining.

Gate reports could just as easily be called "system reports." A gate is an area dedicated to handling calls of similar functional identity and is the designated zone within the ACD where a certain group or bundle of trunks channel their calls into the assigned agents. Statistics gathered at the gate show the effective service level, as perceived by the customer, after the incoming calls have been answered by the ACD. It is within the gate that the average speed of answer and the efficiency of the agents are captured. The gate reports provide a summary of the efficiency of the ACD system as a whole.

Other reports look at additional elements of this summary. The trunk reports will capture the information between seizure of the trunk, answer of the trunk, distribution of the call to an agent, and the final release of the trunk by the central office. The agent reports examine the same time segment collected by the gate reports, except that for the individual agent group, the only meaningful statistics are the handling efficiency of the agent group itself. Average speed of answer is not considered for the agent group alone because this number is only important at the gate level where the calls are actually pulled from a delay queue and assigned to the agents. The duration of the call-handling times, the number of calls handled, and the efficiency of the call-handling process are the important measures within each agent report.

The gate reports generally contain five major areas of statistical information:

1. Incoming Traffic Flow
2. Average Staffing
3. Call-Handling Efficiency Measurements
4. Load-Balancing Statistics
5. Outgoing Traffic Flow

This information may or may not be included in one report. Each vendor cuts the information a slightly different way.

The incoming traffic flow will be reported as offered, handled, and abandoned traffic. These categories are defined in Part III in more detail. In some cases, these categories will be split between the system reports and the trunk reports. Often the system report will only show the handled traffic, with the

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offered and abandoned traffic appearing in the trunk reports or the agent reports. Wherever they appear, this information is essential to track the volume of offered, versus answered, traffic through the ACD.

The average staffing figures will, at a minimum, show how many agents were actually handling traffic during any given time interval. These figures should appear as an average manning figure to account for the percentage of time agents were assigned to answer calls but were not plugged in to accept calls. In a more complete reporting package, the standard reports will include a breakdown of agents manned at primary and secondary assignments, as well as the percent of occupancy and availability for agents within those assignments. Some vendors, notably Teknekron, IBM-Rolm, and Rockwell International, offer a reporting package which collects a set of statistics for each agent under a unique agent identification number.

The call-handling efficiency reports typically include summaries of the average handling time, the average talking time, and the average time after the call is hung up that agents spend doing paperwork related to the call. These efficiency statistics will also show the average speed of answer on the calls, the average delay time in queue, and the overall service level for each gate in the system.

The report fields concerned with load-balancing will show the volume of traffic which was offered at one gate, then shifted to another gate for answer because of a lack of primary agents in the first gate or because the delay queue at the original gate had exceeded customer-specified timing parameters. Typically these report fields will show the amount of traffic each gate answered for other gates.

The fields for outgoing traffic are similar in all of the reports. There are usually two fields, and they show the number of outgoing calls and the average length of time spent on those outcalls.

These categories are collected at the gate or system level. The statistical summaries contained in these reports will be displayed in two or three forms on most ACD's. There will be "real-time" reports, appearing at the system supervisor's and the group supervisor's CRT screens, and there will be a set of printed reports that appear on half-hourly, hourly, and daily intervals. Some ACD's also allow the supervisors to request each of these reports on a demand basis and send them to a CRT or a line printer.

Document is available in the Clearinghouse collection.

The division between gate statistics and information group statistics is one of the more important distinctions in the way reporting statistics are collected at the ACD. The gate is a static entity containing all of the trunks which directly feed that gate and all of the agents assigned to handle calls within the gate. As such, the reports generated at the gate will be a large mass of collected and averaged statistics. This is necessary because an ACD should offer a comparable service level to all of the incoming callers within the homogeneous functional grouping of the gate (with the exception of priority queuing on special trunks). That is, the agents have to be considered as one group in order to measure activity within the whole gate.

Within each gate there are usually sub-groups for which the manager requires reports. These sub-groups may be the supervisor teams, separate training groups, or any other subset within the larger gate unit. The use of information or reporting groups for management reporting purposes allows a sub-group of reports to be generated which can be compared to each other and the performance of the total gate. These two types of reports are collected independently of each other. An agent, for instance, might be assigned to Gate One for general sales calls and be measured as part of the system report on the general sales gate. However, that agent may also be a college graduate trained via a new method. So the agent is placed in Reporting Group Fifteen, which contains a number of agents from Gates One, Three, Five and Seventeen who were all trained under this new program.

Additional cross-references can be obtained by setting up several reporting groups within Gate One that gather statistics for different team configurations or administrative duties within the larger functional grouping (keeping in mind that an agent can only be assigned to one information group at any one time). The reporting groups will usually contain the same types of information as the gate reports, but will be lacking the range of detail. These reports may not include the call-handling efficiency statistics, such as average speed of answer and service level.

The trunk reports provide some of the same information found in the system reports and the information group reports. The traffic flow (in offered, handled, and abandoned calls) will be shown along with the call-handling efficiency (through figures on the average holding time), and the trunk efficiency. The trunk efficiency is reported for a

group of trunks and will include measures of the amount or percentage of time all trunks were busy and the percentage of time the trunks were carrying traffic. In addition, the number of outgoing calls and the average time spent on those calls will be included. The trunk reports will also show a peg count for each trunk group and a list of the trunk types installed at that ACD.

The delayed call reports are another important tool for successfully managing an ACD center. These reports will show how long it took to answer incoming calls and how long the callers would wait in queue until abandoning the effort. Most of these reports will also show the average time spent in queue and the average length of the queue. These are invaluable aids for determining the delay tolerance of the customers and the effectiveness of the defined service level. The combination of gate reports, showing the offered load, and delayed call reports, showing the abandoned traffic rate, fills in the gap produced by using the Erlang C traffic formula. Erlang C does not take accurate account of the abandoned call rate. With the use of these reports, the manager can directly compute the abandoned rate and factor that into staffing decisions.

With the basic set of reports listed above, a manager can effectively staff and control the ACD operation. In order to fine-tune the ACD and derive the maximum performance and economy from the switch, it is necessary to delve a bit deeper and consider some of the special reports.

CHAPTER TWENTY-TWO

ANALYZING THE REPORTS

The high speed, bi-directional, dot matrix printer has been churning out reports for the last three months faster than the office clerk can thread them into plastic binders. The CRT screens are constantly flooded with a vast and confusing array of numbers, symbols, warnings, and codes. The new ACD is in place and doing its electronic best to bury the manager and his staff in an information overload.

A large ACD with a comprehensive Administrative Data System can churn out well over a hundred pages of reports each day, every day of the week. No one can read and analyze all of this material. Most of the information will serve as backup reports should research be needed on a particular area. The manager has to establish key fields that will be examined and specific parameters that signal a need for action.

Since the real-time, or CRT displays, are the mainstay of the minute-by-minute management of the ACD operation, these will be discussed before the printed reports.

The system supervisor's CRT screen is the central control point for the overall operation of the ACD. It is from this screen that the general flow of traffic between the trunks and gates is observed and controlled. The system supervisor is only occasionally concerned with the actual status and operation of a particular team of agents or any individual agent. These activities will be monitored only to determine if there are any bottlenecks in the system as a whole. The system supervisor should have the forecasting charts for each gate in the control area. The required staffing requested by the system supervisor and the team supervisors, as determined by staffing meetings based on projected call volumes, should be listed on this chart along with a head count on the number of employees who are at their stations. If there are significant variations between the required staffing levels and the actual staff on hand, then the master supervisor should make adjustments between the gates and call in the "on-call" employees.

There are some key items the system supervisor should watch for on the reports. The incoming traffic volumes should be compared to the forecasted volumes to determine new trends which will call for more or fewer agents on the floor. A seasoned supervisor can very quickly determine if any given day is going to exceed or fall below the projections by observing the traffic flow early in the day. The service level indicators should track the goals set for the system. At the same time the call-handling efficiency of the agents should be watched to predict whether the expected traffic volume per agent is going to be attainable.

Another useful measure of the system's efficiency are the fields for the queuing statistics. The system supervisor should know, roughly, what types of delay parameters will produce what level of service and what level of lost calls. The necessary adjustments can be made by moving agents among the gates to compensate for high or low traffic. If an overload condition occurs, the supervisor can then remove trunks from service and allow the queue to regain a normal flow. It is very difficult for the traffic flow to recover from an overload condition unless the manager takes positive action. The mathematics of a queuing system point out the futility of hoping an overload will stabilize itself.

The response to these types of problems vary depending on the type of ACD installed. The basic key to catching and solving problems before the congestion or lost revenue reaches a critical point is to continually monitor the actual traffic against a standard that the manager and staff have predicted for that day.

Follow a typical system supervisor, using an imaginary ACD with features from several vendors, through one trouble period and notice the use of various reports to identify, diagnose, and remedy traffic problems. Figure VI-1 is a portion of the printed report which shows data for all the gates. This is a comprehensive view of the call-handling process at the gate level.

SYSTEM REPORT

12 APR 85 12:30

GATE	SERV. LEVEL	OFFER. CALLS	HNDLD CALLS	ABAND. CALLS	ANSWR. SPEED	POSITNS. MANNED
ONE	75	234	227	7	13	31
TWO	94	167	165	2	7	36
THREE	33	3	3	0	43	4
FOUR	0	2	0	2	0	.6
FIVE	3	29	23	6	680	2

Figure VI-1

The system supervisor or manager checks this report against the projected volumes and staffing requirements and notices some immediate problems. Gate Five is falling way behind and Gate Four isn't handling calls at all. Gates One and Two are working about where they're supposed to be and Gate Three is coasting below its efficient levels.

The delayed call report is examined to look for the trouble. This report is shown in Figure VI-2.

DELAYED CALL REPORT

GATE	MAX DLY	0	5	10	15	20	30	40	50	60	180	+UP
ONE	# HANDLED	1	130	17	13	12	12	5	18	9	0	0
TWO	# HANDLED	0	97	32	15	11	1	2	2	5	0	0
THR	# HANDLED	0	0	0	1	0	0	0	0	1	0	0
FOUR	# HANDLED	0	0	0	0	0	0	0	0	0	0	0
FIVE	# HANDLED	0	6	1	0	0	0	1	0	1	0	22

Figure VI-2

Since Gate Five is in the worst trouble, that area is examined first. The Delayed Report displays the classic symptoms of an overload condition. Instead of a normal distribution of calls, with the greatest number grouped around the ideal handling time predicted in the staffing meetings, there is a sprinkling of answered calls throughout the range and a cluster at the end of the chart. This gate is in a crisis situation from which it will not recover on its own. A quick calculation shows that the gate is experiencing 2.48 erlangs of traffic with two agents assigned. Erlang C predicts a probability of delay greater than

100 percent under these conditions. The traffic tables indicate that at least four agents are needed to bring this gate into a stable condition. Since the agents in Gate Three are coasting, those four agents are given secondary assignments in Gate Five to relieve the overload. Another quick calculation (# of Agents X Reporting Interval) - (Handled Calls X Handling Time) shows that these agents have been idle only 58 seconds total during this half-hour period. This is a 98.4 percent occupancy. The supervisor makes a note to congratulate the agents on their efforts and extend some sympathy.

Next the agents in Gate Four are examined. It is not at all clear what has happened here judging from the two reports. It is clear that these agents are either refusing to answer calls or are doing some other work. The supervisor turns to another report to identify the problem. This report gathers the intraflow statistics and checks the work these agents are doing for other gates on a secondary assignment basis. The report is displayed in Figure VI-3.

INTRAFLOW STATUS REPORT

GATE	SECONDARY STAFFED	SECONDARY PERCENTAGE	SECONDARY HANDLED	OVERFLOW HANDLED
ONE	39.7	28	180	0
TWO	6.1	14	26	166
THR	0	0	0	36
FOUR	0	0	0	4
FIVE	0	0	0	0

Figure VI-3

Now it is clear that the agents in Gate Four have been handling calls for some other gate instead of their own. The Overflow Handled column documents the number of calls that agents with a primary assignment in this gate handled for some other gate. Both of the calls offered to Gate Four were lost because the agents were handling calls for Gate One (as shown in the staffing map). A look at the agent group report for those people also shows that their handling time on the secondary assignment was in the neighborhood of 477 seconds. This report is shown in Figure VI-4.

AGENT GROUP SUMMARY

Group 04

POSITIONS STAFFED	HANDLED CALLS	HANDLING TIME	TALKING TIME	WORKING TIME
4	4*	477	145	332

Figure VI-4

This report explains the problem. The handling times for the *calls (which indicates overflow traffic in this ACD) are clearly above the acceptable range. The talking time is fine, but the working time is 332 seconds. A similar report for Gate One shows a working time of 59 seconds.

The excessive work time is probably the result of agents handling calls for an unfamiliar gate. Either a supervisor made the wrong secondary assignments or these agents need additional training in their secondary duties. Because they are spending this much time doing the paperwork for a secondary assignment, their own primary assignment is not being handled.

To complete the analysis for this interval, the trunks should be examined. The trunk report is shown in Figure VI-5. The complete report is reproduced because this ACD has the trunk report built around groups which do not correspond to the agent groups. If at all possible, the trunk and agent groups should be aligned, unless there is a compelling reason to split them up. In this case the manager wanted to look at regional trunk groups regardless of gates.

The trunks with zero offered calls and some number of seconds in the Holding Time and Use Time field are being occupied by outcalls. These are being used very little and are probably uneconomical unless they are DDD circuits. The manager should consider using two-way trunks in these cases. This report shows a system with too little blockage on the trunks throughout the groups. There are very few of these trunk groups experiencing any lost calls at all. This might not be a bad situation. It is possible that this is a slack day and that the excessive trunking is exactly right during the busy day or the busy hour. It does need to be investigated further. In several of the gates there is inadequate staffing to handle the load that these trunks can carry. It might be necessary to reformulate the entire system configuration.

TRUNK TRAFFIC REPORT

GROUP	OFFRD CALLS	HNDLD CALLS	ABAN. CALLS	HELD CALLS	HOLDG TIME	USE TIME	ALL BUSY PERCNT.
1	23	20	3	1	197	302	0
2	0	0	0	0	144	408	0
3	10	8	2	1	64	366	0
4	9	9	0	0	111	127	0
5	0	0	0	0	120	120	0
6	0	0	0	0	100	435	0
7	0	0	0	0	137	91	0
9	0	0	0	0	281	1054	9
10	0	0	0	0	107	161	0
12	84	83	1	21	225	1720	66
13	7	7	0	1	226	792	28
14	14	14	0	3	319	1115	21
15	14	14	0	2	117	547	8
16	15	15	0	4	164	491	0
*	*	*	*	*	*	*	*
47	8	8	0	1	137	1099	61
TOTAL 441	427	14	77	202	572	***	

*This indicates missing groups removed for illustration purposes.

Figure VI-5

With a complete set of reports, the manager can work through and chart all of the critical call-handling problems in the ACD and begin to suggest economical solutions.

CHAPTER TWENTY-THREE

LONG-TERM REPORTS

Long-term reports are an important tool for finding and responding to major trends which alter the traffic patterns at the ACD. In most cases there is no need to examine the half-hourly reports in any detail. A useful feature of the ACD is the ability to turn off the automatic printed reports which appear every half hour and store these extra reports on tape or disk. Generally only the daily summary reports will be important enough to save and discuss at regular meetings among the communications staff.

The agent and the trunk reports are often the most important because these areas determine the system's revenue production. It is sufficient to store the half-hourly reports on tape and either use them as they appear and throw them away, or disable the printing of the reports. The daily printouts should be collected into computer paper binders, labeled, and filed for the two-week to one-month period that they may be useful for analysis and forecasting. The reports saved in this fashion can be useful training tools for the system supervisor and the team supervisors when analyzing the daily operation of the ACD.

Once the basic trends have been extracted, there is little use for the printed reports, unless the ACD does not have the capability of storing the records on disk or tape. The tape reports should be labeled in a consistent manner. Usually the tape label will be some form of the date on which the tape was closed. In multi-node ACD's with network analysis services, it is vital that the tapes use a common labeling scheme. All the tapes from September 5th, for example, can be analyzed without laboriously cross-checking the coded labels.

The long-term reports should be used to graph the long-term traffic patterns and staffing capabilities. Any broad trends will appear during this analysis and the manager can shift the staffing requirements or begin thinking about the need for expansion in the ACD equipment itself.

The historical reports can also be used to detect

any shift in calling patterns. It may be that various regions are calling less than before, that people are calling earlier or later in the day, that the volume of business is shifting from one gate to another. These trends can be passed along to the marketing department or the sales department to determine if additional emphasis is needed in some area or if there is a new market available.

An airline might identify a slow shift away from the general sales gates and into the tour gates. This may indicate that a new advertising campaign, designed to channel customers through local tour offices, is working. There may be a decline in calls from one region of the country. This could indicate that the marketing thrust for that area has become ineffective. A thorough examination of the internal reports may reveal the relevancy of a surprising number of external factors.

The long-term reports are also useful in justifying additional staffing to upper management. These reports will identify peak seasons during which the service level deteriorated. If the ACD is operating within a regulated environment, this historical data can be invaluable for determining why the service level changed during a certain period, or for justifying modification in the type or level of service.

Whether the ACD's reporting structure allows tape records or only printed records, the manager should make some effort to examine the larger trends in the ACD. This information should be summarized and made available to other segments of the corporation.

CHAPTER TWENTY-FOUR

MANAGEMENT REPORTING

The subject of management reporting covers those things which upper level management should and should not know about the operation of the ACD. The primary vehicles for this information flow are the monthly or semi-monthly operating statistics that are passed from the communications management team to the corporate management team.

Typically the ACD management staff will not be autonomous. There will be some requirement for a regular review cycle of the ACD's operation and a statement of current and future budgetary needs. The ACD manager can influence, to some degree, the magnitude and form of the reporting process and should make every effort to insure there is an effective and reasonable reporting requirement. Management reporting functions are all too often an exercise in excessive pencil pushing. Any manager can dream up outrageous reporting requirements. The trick is to produce a set of reports that are informative without requiring an inordinate amount of paperwork.

In general, the reports to upper level management are limited in scope and are confined to averages for peak hours and days. The reports to the external groups should be confined to those necessary to justify the budget and provide management with a sketch of the operating capability of the ACD. The management reports should relate the ACD's defined service level to the operation of the switch in the areas of offered call volume, handled call volume, staffing levels for each gate in terms of average call volumes per agent, trunk service levels as a percentage all trunks busy, cost per call for agents and trunks in each gate, and any plans for additional switch expansion or cost-saving measures.

The reports for management should match the system reports and require as little hand manipulation as possible. Many times the only difference between the reports that are printed at the ACD and the reports which are delivered to upper management are the heading labels.

The only areas which should require some hand calculation are the revenue per gate figures and the comparisons between previous months. It is much more economical to teach management how to read the new reports than constantly translate the ACD reports into the format required by the management guidelines.

In the case where multiple ACD's are interconnected with load-balancing tie lines, or where the ACD is operating as part of a tandem network, the reports to upper management will necessarily be more extensive.

The internal reports should be comprehensive, detailed, accurate, and concise. It is easy to proliferate a blizzard of paper unless the purpose of each report is carefully defined. These reports should contain enough information to clearly display whether or not the ACD center is meeting the stated performance parameters.

CHAPTER TWENTY-FIVE

FORECASTING

Historical data is not always adequate for managing an ACD because the required agent curves are not linear functions of the traffic intensity. There are efficiencies to be gained in large groups. Large groups can simply handle more traffic than small groups. There are possibilities for variations based on the primary, secondary, and tertiary assignment. Interflow between multi-node ACD centers adds another variable to the already confusing mix. A group of agents which consistently handles fifteen calls per half hour under one set of conditions may handle ten more calls per half hour under a different set of conditions. The only way to allow for this type of variation is through forecasting.

Basically, the manager needs to forecast the trunking requirements, the staffing requirements, expansion needs, and the cost tradeoffs among several alternatives.

Forecasting for an ACD is somewhat of a primitive art. Most of the traffic formulas discussed in Part III were designed and tested with PABX traffic or tandem switching applications in mind. The forecasting programs listed below are only a rough tool which individual managers should modify and adjust to match their ACD conditions. The programs are written in BASIC and are designed for a Tandy Model II microcomputer. These programs are available on diskettes for IBM and Radio Shack microcomputers through The Telecom Library.

The first listing calculates values based on the Erlang B formula. This simple routine will print a delay probability value for a given amount of traffic and the requested number of trunks.

The second listing calculates values based on the Erlang C formula. This routine predicts the probability of delay given a certain number of calls trying to reach a specified number of agents.

The third listing is a slightly more complicated version of the Erlang B formula that provides more information about the traffic carried on each line.

The fourth listing calculates AT&T's WATS charges. It can be used to determine the optimum location for a new center, the impact of adding or deleting lines, and virtually any theoretical issue regarding the WATS tariff. The WATS modeling program must access files which contain information about all of the rate steps in the AT&T tariff and the cost of each WATS zone. This information can be obtained from your AT&T representative or ordered through The Telecom Library. The last few listings are examples of file construction routines that can be used to fill the tariff files if you choose construct your own database of WATS information.

The logic of this program must be understood thoroughly before using it or significant miscalculations may result. Once the program is mastered, it can eliminate endless hours of manual analysis required to do WATS optimization.

```
10      CLS
20      'ERLANG B DELAY PROBABILITY ROUTINE
30      INPUT "MAXIMUM CALLS OFFERED PER HALF HOUR";A
40      INPUT "AVERAGE HOLDING TIME PER CALL";A1
50      INPUT "MAXIMUM NUMBER OF TRUNKS";K
60      A=(A*A1)/1800
70      T=0:P=1:P1=1
80      DIM X(K)
90      T=T+1:P=P*A/T:P1=P1+P:P3=P/P1
100     IF P1>1.0E+15 THEN P1=P1/1.0E+15:P=P/1.0E+15
110     I=I+1:X(I)=P3:IF I=K THEN 130
120     GOTO 90
130     INPUT "ENTER # OF TRUNKS FOR DELAY PROBABILITY";K2
140     IF K2=0 THEN END
150     PRINT X(K2):GOTO 130
```

```
5       CLS
10      'ERLANG C DELAY PROBABILITY ROUTINE
20      INPUT "MAXIMUM CALLS OFFERED PER HALF HOUR";A2
30      INPUT "AVERAGE HANDLING TIME PER CALL";A3
40      INPUT "MAXIMUM NUMBER OF AGENTS";AG
50      A2=(A2*A3)/1800
60      T=1:P=1:P1=1:DIM Y(AG)
70      IF T <= A2 THEN 110
80      P2=P*(A2/T)*(T/T-A2):P3=P2/(P1+P2)
90      I=I+1:Y(I)=P3
100     IF I=AG THEN 120
110     P=P*(A2/T):P1=P1+P:T=T+1
112     GOTO 70
120     INPUT "ENTER THE NUMBER OF AGENTS FOR C VALUE";AG
130     IF AG=0 THEN END
140     PRINT Y(AG)
150     GOTO 120
```

```
10      'FILE NAME:              ERLANGB
20      CLS
30      PRINT CHR$(02)           'TURN OFF THE CURSOR
        '*****************************************************************
        PRINT @20,"ERLANG B GRADE OF SERVICE CALCULATION "
60      '*****************************************************************
70      '                INPUT SECTION
80      '*****************************************************************
90      PRINT @170," ENTER THE NUMBER OF CALLS EXPECTED IN A MONTH ";
100     INPUT MCLLS
110     PRINT @250," ENTER THE AVERAGE LENGTH OF THE CALLS IN SECONDS ";
120     INPUT CLNGTH
130     PRINT @330," ENTER THE PERCENTAGE OF CALLS EXPECTED IN THE PEAK HOUR
140     INPUT PEAK
150     PRINT @410," ENTER THE NUMBER OF WORKING DAYS IN THE MONTH ";
160     INPUT MDAYS
170     PRINT @490," ENTER THE GRADE OF SERVICE REQUIRED (e.g. 1 or 5) ";
180     INPUT GSRVC
190     '*****************************************************************
200     '                CALCULATIONS
210     '*****************************************************************
220                     'HOURS IN A MONTH
230     MHRS = (MCLLS * CLNGTH)/3600
240                     'HOURS IN THE PEAK HOUR
250     PHRS = (MHRS/MDAYS) * (PEAK/100)
260                     'CALLS IN THE PEAK HOUR
270     PCLLS = ((PHRS * 3600)/CLNGTH)
280                     'ERLANGS IN THE BUSY HOUR
290     RLNGS = PHRS
300     PRINT @820," PLEASE WAIT--RESULT IS BEING CALCULATED "
310     '*****************************************************************
320     '                CALCULATE ERLANG B
330     I=0:P=1:P1=1
340     DIM X(1000)      'ARRAY TO HOLD SERVICE GRADES
350     I = I + 1
360     PRINT @913," LINE  ";I
370     P = P * (RLNGS/I)
380     P1 = P1 + P
390     P3 = P/P1
400     X(I) = P3        'STORE THE GRADE OF SERVICE
410     IF P3 > 0 AND P3 < (GSRVC/100) THEN 440
420     IF P > 1.0E+5 THEN:P=P/1.0E+5:P1=P1/1.0E+5
430     GOTO 350
440     '
450     '*****************************************************************
460     '       CALCULATE HOURS PER LINE
470     '*****************************************************************
480     C=0
490     DIM L(1000)              'ARRAY TO HOLD HOURS PER LINE
500     FF = PHRS                'SET OFFERED EQUAL TO BUSY HOUR
510     FOR J = 1 TO I
520     C=C+1
```

```
530     OVF = PHRS * X(C)          'OVERFLOW EQUALS OFFERED TIME P FACTOR
540     L(C) = FF-OVF    'CARRIED EQUALS BSYHRS TOTAL MINUS THE OVERFLOW
550     FF =  OVF        'NEW AMOUNT OFFERED EQUALS OFFERED MINUS CARRIED
560     NEXT J
570     C=0
580     FOR J = 1 TO I
590     C=C+1                        'COUNTER FOR LINES
600     PRCT = PRCT + L(C)           'ADD UP HOURS OF TRAFFIC CARRIED PER LINE
610     NEXT J
620     '*****************************************************************
630     '                            DISPLAY SECTION
640     '*****************************************************************
650     CLS:INPUT "HIT ENTER TO DISPLAY GRADE OF SERVICE";Z:CLS
660     K = 0
670     PRINT @100," GRADE OF SERVICE "
680     FOR J = 1 TO I
690     K = K + 1
700     PRINT @320+(K*10),X(J)
710     IF K >159 THEN K = 1:CLS
720     NEXT J
730     PRINT @170," LINES REQUIRED FOR DESIRED GRADE OF SERVICE = ";I
740     PRINT @1600,""
750     INPUT "HIT ENTER TO DISPLAY HOURS CARRIED PER LINE";Z:CLS
760     PRINT @100," HOURS CARRIED IN THE PEAK HOUR PER LINE "
770     K = 0
780     FOR J = 1 TO I
790     K = K + 1
800     PRINT @240+(K*10),L(J)
810     IF K > 150 THEN K = 1:CLS
820     NEXT J
```

```
10 IF H$="H" THEN PRINT"FOR A MAP OF YOUR WATS ZONE COVERAGE."
20 CLS:CLEAR99:GOSUB3080
30 CLS:PRINT @400,"";
40 CLEAR:DEFDBL A-Q:DEFDBL S-Z
50 PRINT"HIT ANY KEY, OTHER THAN 'H' OR 'A' TO BEGIN A STANDARD RUN"
60 PRINT"TYPE THE LETTER 'H' FOR HELP WITH DETAILED INSTRUCTIONS  ":
70 PRINT"TYPE THE LETTER 'A' FOR AN ABBREVIATED RUN FOR EXPERIENCED USERS"
80 H$=INPUT$(1)
90 CLS
100 Q9=0:L1=0:L2=0:L3=0:C1=0:DA=0:D6=0:NA=0:N6=0:EA=0:E6=0
110 DF=0:DS=0:DT=0:DL=0:EF=0:ES=0:ET=0:EL=0:C2=0:C3=0:C4=0
120 CT=0:E1=0:E2=0:E3=0:E4=0:E5=0:N1=0:N2=0:TT=0:X1=0:X2=0
130 X3=0:X4=0:XD=0:X5=0:X6=0:X7=0:X8=0
140 IF H$="H" THEN PRINT @800,"TYPE THE WORD 'IN' TO ANALYZE THE USAGE COSTS ";
150 IF H$="H" THEN PRINT"INCOMING (800) WATS CALL"
160 IF H$="H" THEN PRINT"TYPE THE WORD 'OUT' TO ANALYZE THE USAGE COSTS FOR ";
170 IF H$="H" THEN PRINT"OUTGOING WATS CALL"
180 IF V8=1 THEN:PRINT @457,IO$
190 PRINT @420,"";:INPUT "ENTER 'IN' OR 'OUT' WATS ANALYSIS  ";IO$
200 IF IO$<>"IN" AND IO$<>"OUT" THEN 190'CHECK FOR ERROR
210 CLS
220 IF H$="H" THEN:CLS:PRINT @800, "THE WATS TARIFF IS DIVIDED INTO ZONES WITH";
230 IF H$="H" THEN PRINT"EACH ZONE FROM 1 THROUGH 6 COVERING A LARGER AREA ";
240 IF H$="H" THEN PRINT"OF THE COUNTRY.  CONTACT YOUR AT&T REPRESENTATIVE ";
250 IF V8=1 THEN:PRINT @538,A;
260 PRINT @413,:INPUT"ENTER WATS ZONE NUMBER:   1, 2, 3, 4, 5 OR 6 TO ANALYZE  ";A
270 IF A<1 OR A>6 THEN 260
280 CLS
290 IF H$="A" THEN 440
300 PRINT"01 = ALABAMA    13 = ILLINOIS-N  25 = MINN    37 = N. CAROLINA 49 = TEXAS-E"
310 PRINT"02 = ARIZONA    14 = ILLINOIS-S  26 = MISS    38 = N. DAKOTA   50 = TEXAS-S"
320 PRINT"03 = ARKANSAS   15 = INDIANA     27 = MISSOUR   39 = OHIO-N      51 = TEXAS-W"
330 PRINT"04 = CALIF-N    16 = IOWA        28 = MONTANA 40 = OHIO-S        52 = UTAH"
340 PRINT"05 = CALIF-S    17 = KANSAS      29 = NEBRASKA  41 = OKLAHOMA    53 = VERMONT"
350 PRINT"06 = COLARADO   18 = KENTUCKY    30 = NEVADA  42 = OREGON        54 = VIRGINIA"
360 PRINT"07 = CONNECT    19 = LOUISIANA   31 = NEW HAM 43 = PENN-E        55 = WASH"
370 PRINT"08 = DELAWARE   20 = MAINE       32 = NEW JER   44 = PENN-W      56 = W. VIR"
380 PRINT"09 = D.C.       21 = MARYLAND    33 = NEW MEXIC 45 = R.I.        57 = WISCONSIN"
390 PRINT"10 = FLORIDA    22 = MASS        34 = N YORK-NE 46 = S. CAR      58 = WYOMING"
400 PRINT"11 = GEORGIA    23 = MICHIGAN-N  35 = N YORK-SE 47 = S. DAKOTA  "
410 PRINT"12 = IDAHO      24 = MICHIGAN-S  36 = N YORK-W  48 = TENN"
420 IF H$="H"THEN PRINT @1200,"LOCATE YOUR STATE ON THE LIST ABOVE, TYPE IN ";
430 IF H$="H" THEN PRINT"THE NUMBER CODE FOR THAT STATE AND HIT THE ENTER KEY";
440 IF V8=1 THEN:PRINT @1727,B
450 PRINT @1600,"":INPUT "ENTER NUMBER OF YOUR STATE FROM THE LIST ABOVE";B
460 IF B<1 OR B>59 THEN 280
470 CLS
480 IF V8=1 THEN:PRINT @360,M$
490 PRINT @300,:INPUT "ENTER MONTH UNDER ANALYSIS (OPTIONAL)";M$:PRINT
500 IF V8=1 THEN:PRINT @517,N$
510 PRINT@480,"";:INPUT "ENTER PROFIT CENTER NAME (OPTIONAL)";N$:PRINT
520 X$=CHR$(160)
530 PRINT @1600,STRING$(42,X$):PRINT @1600,"ENTER ALL NUMERICAL VALUES WITHOUT COMMAS."
540 Q9=Q9+1:IF Q9>5 THEN 550ELSE 530
550 IF H$="H"THEN PRINT @1680,"THE 'HOURS OF USAGE' REPRESENTS THE TOTAL ";
560 IF H$="H"THEN PRINT"AMOUNT OF CALLING TRAFFIC HANDLED DURING THE MONTH";
570 IF V8=1 THEN:PRINT @685,DX
580 PRINT @640,;:INPUT "ENTER TOTAL HOURS OF USAGE FROM 8 AM TO 5 PM";DX:DYHRS=DX
590 IF V8=1 THEN:PRINT @766,CX
600 PRINT @720,;:INPUT "ENTER TOTAL NUMBER OF CALLS FROM 8 AM TO 5 PM";CX:C7=CX
```

```
610 IF C7 = 0 THEN PRINT"YOU MUST ENTER SOME CALL VOLUME TO ANALYZE":GOTO 580
620 P1=(DYHRS*3600)/C7:L1=P1
630 IF P1<60 THEN P2=(60/P1):DYHRS=(DYHRS*P2):G1=1:REM MIN BILL CORRECTION
640 IF V8=1 THEN:PRINT@926,EX
650 PRINT @880,;:INPUT "ENTER TOTAL HOURS OF USAGE FROM 5 PM TO 11 PM";EX:EVENINGHRS=EX
660 IF V8=1 THEN:PRINT @1007,CV
670 PRINT @960,;:INPUT "ENTER TOTAL NUMBER OF CALLS FROM 5 PM TO 11 PM";CV:C8=CV
680 IF EV=0 THEN 710
690 Q1=(EVENINGHRS*3600)/C8:L2=Q1
700 IF Q1<60 THEN Q2=(60/Q1):EV=EV*Q2:G2=1
710 IF V8=1 THEN PRINT @1166,NX
720 PRINT @1120,;:INPUT "ENTER TOTAL HOURS OF USAGE FROM 11 PM TO 8 AM";NX:NIGHTHRS=NX
730 IF V8=1 THEN:PRINT @1247,CZ
740 PRINT @1200,;:INPUT "ENTER TOTAL NUMBER OF CALLS FROM 11 PM TO 8 AM";CZ:C9=CZ
750 IF NI=0 THEN 790
760 O1=(NIGHTHRS*3600)/C9:L3=O1
770 IF O1<60 THEN O2=(60/O1):NI=NIGHTHRS*O2:G3=1:REM MIN BILL CORRECTION
780 PRINT
790 PRINT:PRINT"TYPE IN 'Y' IF ALL INFORMATION IS CORRECT, OTHERWISE TYPE IN 'N'.    ";
800 I$=INPUT$(1):IF I$="N" THEN 580
810 IF I$<>"Y" THEN 820ELSE 830
820 IF I$<>"N" THEN 580
830 IF H$<>"H" THEN 970ELSE CLS
840 PRINT"THIS SECTION CALCULATES THE AVERAGE NUMBER OF WATS LINES USED"
850 PRINT"DURING THE MONTH.  IF 25 LINES WHERE IN FOR A FULL MONTH THEN ENTER"
860 PRINT"25 LINES FOR 30 DAYS.  30 DAYS EQUALS A MONTH UNDER THE WATS TARIFF."
870 PRINT"YOUR USAGE CHARGES WILL BE CALCULATED USING THESE FIGURES AND YOU ARE"
880 PRINT"BILLED ACCORDING TO THE AVERAGE NUMBERS OF LINES IN USE."
890 PRINT:PRINT"THE BASIC LINE CHARGES ARE FIGURES AUTOMATICALLY BY THE PROGRAM."
900 PRINT"EVEN IF A LINE IS IN FOR ONLY ONE OR TWO DAYS YOU ARE CHARGED THE"
910 PRINT"FULL MONTHLY BASIC RATE.  WHEN YOU HAVE COMPLETED ENTERING THE"
920 PRINT"NUMBER OF LINES YOU USED THEN ENTER A '0' WHEN THE PROGRAM ASKS"
930 PRINT"YOU TO 'INPUT THE NUMBER OF LINES.'
940 PRINT
950 PRINT"WHEN YOU HAVE READ THE DIRECTIONS HIT THE 'ENTER' KEY"
960 K$=INKEY$:IF K$="" THEN 960
970 CLS
980 H=0:WATSL=0:L=0:D=0:S=0:W=0
990 IF V8=1 THEN:PRINT @361,H
1000 PRINT @340,;:INPUT"NUMBER OF LINES =    ";L
1010 IF L=0 GOTO 1050
1020 IF V8=1 THEN:PRINT @526,D
1030 PRINT @500,;:INPUT"FOR THIS MANY DAYS =     ";D
1040 PRINT @900,; "ENTER '0' TO END INPUT"
1050 S=L*D:W=W+S:H=H+L:IF L <>0 GOTO 1000
1060 WATSL = W/30:IF WATSL=0 THEN PRINT @40,"YOU MUST ENTER SOME LINES":GOTO 1000
1070 IF A$="N" THEN PRINT @693,STRING$(20,160)
1080 PRINT @660,"AVERAGE LINES FOR THE MONTH    = ";WATSL
1090 IF V8=1 THEN:PRINT @1745,MI
1100 PRINT @1640,"":INPUT "TOTAL MISCELLANEOUS COSTS THIS MONTH";MISC
1110 PRINT "IS THE INFORMATION CORRECT? ENTER 'Y' OR 'N'";
1120 A$=INPUT$(1):IF A$="Y" THEN 1140ELSE 980
1130 IF A$<>"OK" THEN CLS:GOTO 980
1140 CLS:PRINT:PRINT:PRINT:PRINT:PRINT TAB(30)"RUNNING PROGRAM"
1150 REM REM
1160 REM REM              HOURLY BREAKDOWN ANALYSIS
1170 REM REM
1180 DAVR=(DYHRS/WATSL)
1190 D6=DAVR
1200 EAVR=(EVENINGHRS/WATSL)
```

```
1210 E6=EAVR
1220 NAVR=(NIGHTHRS/WATSL)
1230 N6=NAVR
1240 IF DAVR<15 THEN DFIRST=DAVR:DAVR=(DAVR-DAVR)
1250 IF DAVR>=15 THEN DFIRST=15:DAVR=(DAVR-15)
1260 IF DAVR<25 THEN DSECND=DAVR:DAVR=(DAVR-DAVR)
1270 IF DAVR>=25 THEN DSECND=25:DAVR=(DAVR-25)
1280 IF DAVR<40 THEN DTHIRD=DAVR:DAVR=(DAVR-DAVR)
1290 IF DAVR>=40 THEN DTHIRD=40:DAVR=(DAVR-40)
1300 IF DAVR>0 THEN DLAST=DAVR:DAVR=0
1310 IF EAVR<15 THEN EFIRST=EAVR:EAVR=(EAVR-EAVR)
1320 IF EAVR>=15 THEN EFIRST=15:EAVR=(EAVR-15)
1330 IF EAVR<25 THEN ESECND=EAVR:EAVR=(EAVR-EAVR)
1340 IF EAVR>=25 THEN ESECND=25:EAVR=(EAVR-25)
1350 IF EAVR<40 THEN ETHIRD=EAVR:EAVR=(EAVR-EAVR)
1360 IF EAVR>=40 THEN ETHIRD=40:EAVR=(EAVR-40)
1370 IF EAVR>0 THEN ELAST=EAVR:EAVR=0
1380 IF NAVR>0 THEN NAVR=NAVR
1390 REM REM              COST ANALYSIS
1400 REM REM
1410 REM REM              GET THE COST VARIABLES
1420 REM REM
1430 GOSUB 2520
1440 REM REM
1450 REM REM              DAY RATE COST ANALYSIS
1460 C1DAY=(DFIRST*R1DAYRATE)*WATSL:REM FIRST RATE STEP CHARGE TIMES LINES
1470 C2DAY=(DSECND*R2DAYRATE)*WATSL:REM SECOND RATE STEP CHARGE TIMES LINES
1480 C3DAY=(DTHIRD*R3DAYRATE)*WATSL:REM THIRD RATE STEP TIMES LINES
1490 C4DAY=(DLAST*R4DAYRATE)*WATSL:REM LAST RATE STEP CHARGE TIMES LINES
1500 CTDAY=(C1+C2+C3+C4):REM TOTAL DAY COST
1510 REM REM
1520 REM REM TAB(2)EVENING COST ANALYSIS SECTION
1530 REM REM
1540 E1EVENING=(EFIRST*R5EVENRATE)*WATSL:REM FIRST RATE TIMES LINES
1550 E2EVENING=(ESECND*R6EVENRATE)*WATSL:REM SECOND RATE TIMES LINES
1560 E3EVENING=(ETHIRD*R7EVENRATE)*WATSL:REM THIRD RATE TIMES LINES
1570 E4EVENING=(ELAST*R8EVENRATE)*WATSL:REM LAST RATE TIMES LINES
1580 E5EVENING=(E1+E2+E3+E4)
1590 REM REM                  NIGHT COST ANALYSIS
1600 REM REM
1610 N1NIGHT=(NAVR*R9NIGHTRATE)
1620 N2NIGHT=(N1NIGHT*WATSL)
1630 REM REM
1640 REM REM              FINAL COST ANALYSIS ALL LINES
1650 REM REM
1660 TT=(CTDAY+E5EVENING+N2NIGHT):REM ADD HOURLY TOTALS
1670 TT=(TT+MISC)+(H * BASE):REM ADD MISC COSTS AND LINE BASE CHARGES
1680 TT=(TT*T2)+TT
1690 CLS
1700 X1=(DYHRS+EVENINGHRS+NIGHTHRS):X2=((BASE*H)*T2)+(BASE*H)
1710 XD=DYHRS/X1:XE=EVENINGHRS/X1:XN=NIGHTHRS/X1
1720 X3=(XD*X2)+CTDAY:X4=(XE*X2)+E5EVENING:X5=(XN*X2)+N2NIGHT
1730 X6=X3/C7:IF C8=0 THEN 1750
1740 X7=X4/C8:IF C9=0 THEN 1770
1750 IF C9=0 THEN 1770
1760 X8=X5/C9
1770 REM JUMP HERE IF DIVISION BY ZERO IS POSSIBLE
1780 REM REM
1790 REM REM              OUTPUT SECTION
1800 REM REM
```

```
1810 REM REM
1820 REM REM              CRT OUTPUT
1830 REM REM
1840 CLS
1850 PRINT TAB(25)"WATS COST ANALYSIS"
1860 PRINT:PRINT:PRINT TAB(2)"MONTH    =    ";M$,"PROFIT CENTER      =    ";N$
1870 PRINT:PRINT
1880 PRINT TAB(14)"AVERAGE";"       MONTHLY";"      AVERAGE";"      AVERAGE"
1890 PRINT"               HOURS USAGE   USAGE COST   COST/CALL   CALL LENGTH   COST/SECOND"
1900 PRINT
1910 PRINT "8 TO 5",
1920 PRINT USING "###.#";D6;
1930 PRINT"    ";
1940 PRINT USING "$$#######,.#";CTDAY;
1950 PRINT"    ";
1960 PRINT USING "$$###.####";X6;
1970 PRINT"       ";
1980 PRINT USING "###.#";L1;
1990 PRINT TAB(1),
2000 IF L1=0 THEN 2020
2010 PRINT USING "$$#.######";X6/L1
2020 PRINT
2030 PRINT"5 TO 11";
2040 PRINT"          ";
2050 PRINT USING "###.#";E6;
2060 PRINT"    ";
2070 PRINT USING "$$#######,.#";E5;
2080 PRINT"    ";
2090 PRINT USING "$$###.####";X7;
2100 PRINT "       ";
2110 PRINT USING "###.#";L2;
2120 PRINT TAB(1),
2130 IF L2=0 THEN 2150
2140 PRINT USING "$$#.######";X7/L2
2150 PRINT
2160 PRINT"11 TO 8";
2170 PRINT"          ";
2180 PRINT USING "###.#";N6;
2190 PRINT"    ";
2200 PRINT USING "$$#######,.#";N2,
2210 PRINT "    ";
2220 PRINT USING "$$###.####";X8,
2230 PRINT "       ";
2240 PRINT USING "###.#";L3;
2250 IF L3=0 THEN 2280:PRINT "          ",
2260 PRINT TAB(1),
2270 PRINT USING"$$#.######";X8/L3
2280 PRINT:PRINT
2290 PRINT TAB(20)"WATS ZONE       =";A," STATE CODE  =",B
2300 PRINT
2310 PRINT TAB(20)"BILLABLE LINES    =  ";
2320 PRINT USING "########";H
2330 PRINT TAB(20)"USAGE TOTAL       =  ";
2340 PRINT USING "$$######,.##";E5+CT+N2
2350 PRINT TAB(20)"BASE COSTS        =  ";
2360 PRINT USING "$$######,.##";H*BASE
2370 PRINT TAB(20)"TOTAL COST        =  ";
2380 PRINT USING "$$######,.##";TT
2390 PRINT TAB(20)"TOTAL CALLS       =    ";
2400 PRINT USING "#######,";C7+C8+C9
```

```
2410 PRINT:INPUT"DO YOU WANT TO PRINT RESULTS?  ENTER 'YES' OR 'NO'";A$
2420 IF A$="NO" GOTO 2450
2430 REM REM              PRINTED OUTPUT
   0 SYSTEM "SCREEN"                'REM TRY TO PRINT THE SCREEN
   0 REM
2460 INPUT"DO YOU WANT ANOTHER RUN?  ENTER 'YES' OR 'NO'";A$
2470 IF A$="YES" THEN V8=1:GOTO 90
2480 CLS
2490 END
2500 REM
2510 STOP
2520 REM                          FILE CONTROL FOR RATE TABLES
2530 IF BX<>B THEN 2560
2540 IF V8=1 AND BX=B THEN 2660'SKIP FILE SEARCH IF NO CHANGE
2550 STOP
2560 REM
2570 IX$="R":BX=B                 'SET THE RERUN FLAG
2580 REM                          OPEN "STEP/DAT" STATE CODE ZONE TABLES
2590 OPEN "D",1,"STEP/DAT",12
2600 FIELD 1,2 AS R1$,2 AS R2$,2 AS R3$,2 AS R4$,2 AS R5$,2 AS R6$
2610 REM
2620 REM                          RETRIEVE THE ZONE CODES FOR THE STATE
2630 REM
2640 GET 1,B
2650 V1=CVI(R1$):V2=CVI(R2$):V3=CVI(R3$):V4=CVI(R4$):V5=CVI(R5$):V6=CVI(R6$)
2660 IF IX$=IO$ AND AA=A THEN 2850
2670 IF IO$= "OUT" THEN 2850
2680 IX$=IO$:AA=A
2690 OPEN "D",2,"EIGHT/DAT",45
   0 FIELD 2,5 AS R1$,5 AS R2$,5 AS R3$,5 AS R4$,5 AS R5$,5 AS R6$,5 AS R7$,5 AS R8$,5 AS R9$
   0 REM
2720 REM                          RETRIEVE THE IN 800 WATS
2730 IF A=1 THEN W=V1
2740 IF A=2 THEN W=V2
2750 IF A=3 THEN W=V3
2760 IF A=4 THEN W=V4
2770 IF A=5 THEN W=V5
2780 IF A=6 THEN W=V6
2790 GET 2,W
2800 R1=CVS(R1$):R2=CVS(R2$):R3=CVS(R3$):R4=CVS(R4$):R5=CVS(R5$)
2810 R6=CVS(R6$):R7=CVS(R7$):R8=CVS(R8$):R9=CVS(R9$)
2820 CLOSE
2830 BASE=35.35:T2=.02
2840 RETURN
2850 REM          OPEN THE OUT WATS TABLE
2860 IF IZ$=IO$ AND AA=A THEN RETURN
2870 IF IX$=IO$ AND AA=A THEN RETURN
2880 IZ$=IO$:AA=A
2890 OPEN "D",3,"OUTRATE/DAT",45
2900 FIELD 3,5 AS R1$,5 AS R2$,5 AS R3$,5 AS R4$,5 AS R5$,5 AS R6$,5 AS R7$,5 AS R8$,5 AS R9$
2910 REM
2920 REM          RETRIEVE THE OUT CHARGES
2930 REM
2940 IF A=1 THEN W=V1
2950 IF A=2 THEN W=V2
2960 IF A=3 THEN W=V3
2970 IF A=4 THEN W=V4
2980 IF A=5 THEN W=V5
2990 IF A=6 THEN W=V6
3000 GET 3,W
```

```
3010 R1=CVS(R1$):R2=CVS(R2$):R3=CVS(R3$):R4=CVS(R4$):R5=CVS(R5$)
3020 R6=CVS(R6$):R7=CVS(R7$):R8=CVS(R8$):R9=CVS(R9$)
3030 CLOSE
3040 BASE = 30.40:T2=.02:                    'BASIC LINE CHARGES AND TAX
3050 'TAX AND BASIC CHARGES MUST BE ADJUSTED FOR YOUR STATE & TARIFF
3060 RETURN
3070 END
3080 Y=80:X=8:Z$=CHR$(149)
3090 PRINT@0,STRING$(80,Z$);
3100 PRINT@80,STRING$(80,Z$);
3110 PRINT@Y,STRING$(X,Z$);:Y=Y+76:X=X+4
3120 IF X<95GOTO3110ELSEPRINT@Y,STRING$(88,Z$);
3130 PRINT@265,"WATS ANALYZER";:
3140 PRINT@412,"STEVEN C. GRANT AND YVONNE BROOKS GRANT";:
3150 PRINT@578,"THE TELECOM LIBRARY, 1985";:
3160 FORJ=1TO2000:NEXT:RETURN
```

Scanned with CamScanner

```
10 REM                    WATS ZONE RATE TABLE
20 REM                    FILE NAME:  "STEP/CMD"
30 REM                    BUILDS THE "STEP/DAT" FILE FOR ALL STATES
40 REM
50 OPEN "D",1,"STEP/DAT",12
60 PRINT "ENTER '0' TO END FILE UPDATE"
70 INPUT "ENTER FIELD NUMBER ";X
80 IF X=0 GOTO 180
90 FIELD 1, 2 AS R1$,2 AS R2$,2 AS R3$,2 AS R4$,2 AS R5$,2 AS R6$
100 INPUT "ENTER FIRST FIELD DATA";Y:LSET R1$=MKI$(Y)
110 INPUT "ENTER SECOND FIELD DATA";Y:LSET R2$=MKI$(Y)
120 INPUT "ENTER THIRD FIELD DATA";Y:LSET R3$=MKI$(Y)
130 INPUT "ENTER FOURTH FIELD DATA";Y:LSET R4$=MKI$(Y)
140 INPUT "ENTER FIFTH FIELD DATA";Y:LSET R5$=MKI$(Y)
150 INPUT "ENTER SIXTH FIELD DATA";Y:LSET R6$=MKI$(Y)
160 PUT 1,X:IF X=0 THEN CLOSE:IF X=0 THEN END
170 GOTO 70
180 IF X=0 THEN END
190 END
```

```
10 REM                    WATS ZONE RATE TABLE
20 REM
30 REM                    FILE NAME "OUTRATE/CMD" BUILDS CHARGE TABLE
40 OPEN "D",2,"OUTRATE/DAT",45
50 INPUT "ENTER FIELD NUMBER ";X
60 IF X=0 GOTO 180
70 FIELD 2, 5 AS R1$,5 AS R2$,5 AS R3$,5 AS R4$,5 AS R5$,5 AS R6$,5 AS R7$,5 AS R8$,5 AS
80 INPUT "ENTER FIRST FIELD DATA";Y:LSET R1$=MKS$(Y)
90 INPUT "ENTER SECOND FIELD DATA";Y:LSET R2$=MKS$(Y)
100 INPUT "ENTER THIRD FIELD DATA";Y:LSET R3$=MKS$(Y)
110 INPUT "ENTER FOURTH FIELD DATA";Y:LSET R4$=MKS$(Y)
120 INPUT "ENTER FIFTH FIELD DATA";Y:LSET R5$=MKS$(Y)
130 INPUT "ENTER SIXTH FIELD DATA";Y:LSET R6$=MKS$(Y)
140 INPUT "ENTER SEVENTH FIELD DATA";Y:LSET R7$=MKS$(Y)
150 INPUT "ENTER EIGHTH FIELD DATA";Y:LSET R8$=MKS$(Y)
160 INPUT "ENTER NINTH FIELD DATA";Y:LSET R9$=MKS$(Y)
170 PUT 2,X
180 IF X=0 THEN CLOSE
190 IF X=0 THEN END
200 GOTO 50
210 END
```

```
10 REM                    WATS ZONE RATE TABLE
20 REM
30 REM                    FILE NAME "EIGHT/CMD" BUILDS THE CHARGE TABLE
40 OPEN "D",2,"EIGHT/DAT",45
50 INPUT "ENTER FIELD NUMBER 1-10";X
60 IF X=0 GOTO 180
70 FIELD 2, 5 AS R1$,5 AS R2$,5 AS R3$,5 AS R4$,5 AS R5$,5 AS R6$,5 AS R7$,5 AS R8$,5 AS R9$
80 INPUT "ENTER FIRST FIELD DATA";Y:LSET R1$=MKS$(Y)
90 INPUT "ENTER SECOND FIELD DATA";Y:LSET R2$=MKS$(Y)
100 INPUT "ENTER THIRD FIELD DATA";Y:LSET R3$=MKS$(Y)
110 INPUT "ENTER FOURTH FIELD DATA";Y:LSET R4$=MKS$(Y)
120 INPUT "ENTER FIFTH FIELD DATA";Y:LSET R5$=MKS$(Y)
130 INPUT "ENTER SIXTH FIELD DATA";Y:LSET R6$=MKS$(Y)
140 INPUT "ENTER SEVENTH FIELD DATA";Y:LSET R7$=MKS$(Y)
150 INPUT "ENTER EIGHTH FIELD DATA";Y:LSET R8$=MKS$(Y)
160 INPUT "ENTER NINTH FIELD DATA";Y:LSET R9$=MKS$(Y)
170 PUT 2,X
180 IF X=0 THEN CLOSE
190 IF X=0 THEN END
200 GOTO 50
210 END
```

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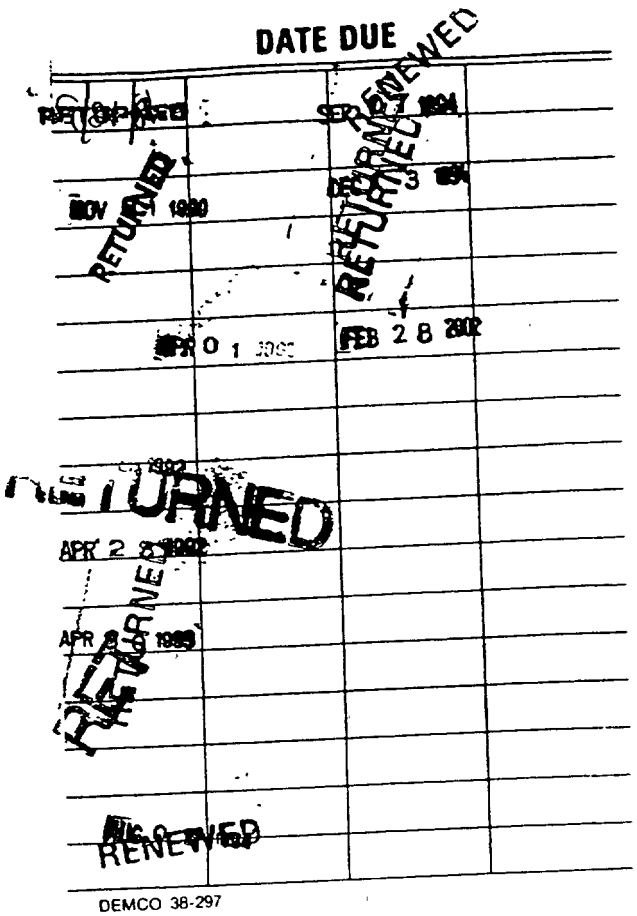
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United States District Court,
E.D. Pennsylvania.

Ronald A. KATZ, Technology Licensing, L.P., and MCI Telecommunications Corporation, Plaintiffs,
v.
AT & T CORPORATION, et al., Defendants.

No. CIV. A. 97-4453.

Aug. 26, 1999.

Owner of patents for interactive voice response system sued telephone company for infringement. The District Court, Lowell A. Reed, Jr., Senior District Judge, construed claim language.

Claims construed.

West Headnotes

[1] **Patents** 314(5)
291k314(5) Most Cited Cases

Construction of patent claims is exclusively within province of court to determine as matter of law.

[2] **Patents** 159
291k159 Most Cited Cases

[2] **Patents** 165(1)
291k165(1) Most Cited Cases

[2] **Patents** 167(1)
291k167(1) Most Cited Cases

[2] **Patents** 168(2.1)
291k168(2.1) Most Cited Cases

In construing patent claim, court should consider claim language, specification, and, if offered, prosecution history, which are collectively considered intrinsic evidence of meaning of claim terms; under some circumstances, court may also consult evidence extrinsic to patent, such as technical dictionaries or expert testimony as to how those skilled in relevant art under consideration would interpret claims.

[3] **Patents** 161
291k161 Most Cited Cases

Absent special and particular definition created by patent applicant, term in patent claim is construed to mean what person of ordinary skill in art at time of invention would have understood term to mean.

[4] **Patents** 157(1)
291k157(1) Most Cited Cases

Unless otherwise compelled, court should give full effect to ordinary meaning of patent claim terms, even if terms are broad.

[5] **Patents** 162
291k162 Most Cited Cases

[5] **Patents** 167(1)
291k167(1) Most Cited Cases

[5] **Patents** 168(2.1)
291k168(2.1) Most Cited Cases

Once court construing patent terms has determined ordinary meaning of the claim term, it must also consider specification and prosecution history to determine if patentee used term in manner inconsistent with its ordinary meaning.

[6] **Patents** 167(1.1)
291k167(1.1) Most Cited Cases

One may not read limitation into patent claim from written description, but one may look to written description to define term already in claim limitation, for claim must be read in view of specification of which it is part.

[7] **Patents** 167(1)
291k167(1) Most Cited Cases

While additional limitations may not be imported into patent claim from specification, court may construe limitation specifically recited in claim in light of specification.

[8] **Patents** 167(1.1)
291k167(1.1) Most Cited Cases

In order to inject definition into patent claim from written description, claim must explicitly contain term in need of definition.

[9] **Patents** 167(1.1)
291k167(1.1) Most Cited Cases

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Patent claim term should not be narrowed by content of specification unless language of claim invites reference to those sources.

[10] Patents 162
291k162 Most Cited Cases

Patent claim term may be given definition other than its ordinary meaning if patentee chooses to be his or her own lexicographer by explicitly setting forth definition in specification, or if terms chosen by patentee so deprive claim of clarity that there is no means by which scope of claim may be ascertained from language used.

[11] Patents 168(2.1)
291k168(2.1) Most Cited Cases

Prosecution history cannot enlarge, diminish, or vary limitations in patent claims.

[12] Patents 168(2.1)
291k168(2.1) Most Cited Cases

Court construing patent claim may consider prior art cited in prosecution history, which may contain clues as to what claim does not cover.

[13] Patents 168(2.1)
291k168(2.1) Most Cited Cases

If patent applicant takes position before Patent and Trademark Office, such that competitor would reasonably believe that applicant had surrendered relevant subject matter, applicant may be barred from asserting inconsistent position when issued patent is subsequently construed.

[14] Patents 168(2.1)
291k168(2.1) Most Cited Cases

Unless altering claim language to escape examiner rejection, patent applicant only limits claims during prosecution by clearly disavowing claim coverage, that is, by making statement that concedes or disclaims coverage of claims at issue based on piece of prior art.

[15] Patents 159
291k159 Most Cited Cases

Extrinsic evidence is to be used for court's understanding of patent, not for purpose of varying or contradicting claim terms.

[16] Patents 159
291k159 Most Cited Cases

Extrinsic evidence may be consulted if court is not familiar with terminology of art in which patent is written, but it should not be consulted to clarify ambiguity in claim terms.

[17] Patents 159
291k159 Most Cited Cases

Where patent documents are unambiguous, expert testimony regarding meaning of claim is entitled to no weight.

[18] Patents 101(8)
291k101(8) Most Cited Cases

Presumption that use of term "means" in patent claim invokes means plus function limitations may be rebutted if claim recites no function which corresponds, or if claim recites function but also recites sufficient structure or material for performing claimed function. 35 U.S.C.A. § 112.

[19] Patents 101(8)
291k101(8) Most Cited Cases

Structural term in patent claim need not connote precise physical structure to those of ordinary skill in art in order to avoid means-plus-function analysis, so long as it conveys variety of structures that are referred to by that term. 35 U.S.C.A. § 112.

[20] Patents 226.7
291k226.7 Most Cited Cases

If structure is defined in patent specification in way unrelated to recited function in means-plus-function clause in claim, those additional aspects of structure should not be read as limiting scope of means clause. 35 U.S.C.A. § 112.

[21] Patents 101(8)
291k101(8) Most Cited Cases

In construing means plus function claims, generally a court should not import function of working device or preferred embodiment into claims as part of "means" if such function is not part of function recited in claims. 35 U.S.C.A. § 112.

[22] Patents 101(2)
291k101(2) Most Cited Cases

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"Communication facility," called for in patent claims for interactive voice response system, was that part of telephone network that enabled caller to connect to patented system; term did not encompass elements or processes of entire public switched telephone network, or require that system be operated only outside network.

[23] Patents 101(2)
291k101(2) Most Cited Cases

"Interface structure" for analysis control system, called for in patent claims for interactive voice response system, referred to hardware and software required to connect processors upon which system was running to communication facility such that information from facility and remote terminals could be provided to and received by system; in context, phrase also included means to perform specific function of providing caller data signals representative of data developed at remote terminals, and means to perform specific function of receiving calling number identification data.

[24] Patents 101(8)
291k101(8) Most Cited Cases

Critical factor in determining whether term in patent claim limitation which does not invoke "means for" language is subject to means-plus-function analysis despite contrary presumption is whether term brings to mind set of structures to those of ordinary skill in art, and not whether term is written in functional language. 35 U.S.C.A. § 112.

[25] Patents 101(2)
291k101(2) Most Cited Cases

"Means to provide caller data signals" and "means to receive calling number identification data," called for in patent claims for interactive voice response system, were limited to disclosed structures which specifically performed those functions. 35 U.S.C.A. § 112.

[26] Patents 101(2)
291k101(2) Most Cited Cases

"Voice generator" for analysis control system, called for in patent claims for interactive voice response system, meant device for generating vocal instructions or prompts to individual callers at remote terminals.

[27] Patents 101(2)
291k101(2) Most Cited Cases

"Record structure" for analysis control system, called for in patent claims for interactive voice response system, referred to means for entering or making use of files, but did not delineate or restrict types of functions that could be performed on files once they were accessed.

[28] Patents 101(2)
291k101(2) Most Cited Cases

"Qualification structure" for analysis control system, called for in patent claims for interactive voice response system, was limited to disclosed structures which performed function of controlling access to system by individual callers. 35 U.S.C.A. § 112.

[29] Patents 101(2)
291k101(2) Most Cited Cases

"Means for selecting," called for in patent claims for interactive voice response system, was limited to disclosed structures which specifically performed function of selecting format based on called number. 35 U.S.C.A. § 112.

[30] Patents 101(2)
291k101(2) Most Cited Cases

"Switching structure" for analysis control system, called for in patent claims for interactive voice response system, meant device, including hardware and associated software, that could switch or route telephone calls or signals from one location or connection to another.

[31] Patents 101(2)
291k101(2) Most Cited Cases

"Record testing structure" for analysis control system, called for in patent claims for interactive voice response system, was limited to disclosed structures which specifically performed function of receiving and testing signals against stored data. 35 U.S.C.A. § 112.

[32] Patents 101(2)
291k101(2) Most Cited Cases

Term "processing," called for in patent claims for interactive voice response system, meant manipulation of data which performed some operation or sequence of operations on data.

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[33] Patents 101(2)
291k101(2) Most Cited Cases

Term "format," called for in patent claims for interactive voice response system, meant computer program that set forth content and sequence of steps to gather information from and convey information to callers through pre-recorded voice prompts and messages.

[34] Patents 101(2)
291k101(2) Most Cited Cases

"Multiple formats" or "plurality of formats," called for in patent claims for interactive voice response system, meant more than one format; terms did not include subroutines or branching within single format.

[35] Patents 101(2)
291k101(2) Most Cited Cases

"Remote terminals," called for in patent claims for interactive voice response system, meant devices or instruments for connecting callers to telephone network for voice and digital communication, including, but not limited to, conventional telephones.

[36] Patents 101(2)
291k101(2) Most Cited Cases

"DNIS" and "called number identification data," called for in patent claims for interactive voice response system, were synonymous, and meant signal or data that identified number called.

[37] Patents 101(2)
291k101(2) Most Cited Cases

"ANI" and "calling number identification data," called for in patent claims for interactive voice response system, were synonymous, and meant signal that identified calling number, i.e., number from which call originated.

[38] Patents 101(2)
291k101(2) Most Cited Cases

"In-band" or "out-of-band" signaling, called for in patent claims for interactive voice response system, did not require or exclude any particular manner of transmission or type of signaling.

[39] Patents 101(2)
291k101(2) Most Cited Cases

"Consumable participation key," called for in patent claims for interactive voice response system, meant number or word that allowed caller access to service or part of service predefined limited number of times and which could not be refreshed or recharged.

[40] Patents 101(2)
291k101(2) Most Cited Cases

"Limit on use," called for in patent claims for interactive voice response system, meant control that limited caller's access to service based on some predetermined method of measuring level of use; term was not restricted to specific method of measuring use, such as limited number of accesses into system.

[41] Patents 101(2)
291k101(2) Most Cited Cases

"Products carrying participation numbers," called for in patent claims for interactive voice response system, meant physical items sold or exchanged in commercial setting which carried number allowing participation in system.

[42] Patents 101(2)
291k101(2) Most Cited Cases

"Accounting data," called for in patent claims for interactive voice response system, meant information relating to computation of data.

[43] Patents 101(2)
291k101(2) Most Cited Cases

"Operations of an interface," referred to in patent claims for interactive voice response system, meant processes, activities, or functions of interactive connection between processors upon which system was running, communication facility, and callers; phrase did not require that system be running one of the formats disclosed in the specifications.

[44] Patents 101(2)
291k101(2) Most Cited Cases

"Answer data," called for in patent claims for interactive voice response system, meant responses from callers to vocal questions or prompts.

[45] Patents 101(2)
291k101(2) Most Cited Cases

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"Testing the selected format," called for in patent claims for interactive voice response system, meant method by which it was determined whether any conditions associated with format that had been selected by call data signals were satisfied.

[46] Patents 101(11)
291k101(11) Most Cited Cases

Where plain meaning of method claim language indicates sequential nature to claim steps and specification does not suggest otherwise, steps must be performed in order written in claim.

[47] Patents 101(11)
291k101(11) Most Cited Cases

Basic steps listed in method claims of patents for interactive voice response system, i.e., receiving call data signals, selecting format, testing selected format, and conditionally interfacing, had to be performed sequentially; additional steps listed in claims, however, did not have to be performed in any particular order.

[48] Patents 101(2)
291k101(2) Most Cited Cases

"Call data signals," called for in testing step of patent claims for interactive voice response system, referred to number from which call originated.

[49] Patents 101(2)
291k101(2) Most Cited Cases

"Conditionally interfacing," referred to in patent claims for interactive voice response system, meant connecting call to selected format once any conditions associated with that format had been satisfied.

[50] Patents 101(2)
291k101(2) Most Cited Cases

"Live Operator Attended Terminals," called for in patent claims for interactive voice response system, did not require that prompts displayed at operating stations be identical to vocal prompts used in automated formats.

[51] Patents 101(2)
291k101(2) Most Cited Cases

"Selecting a processing format" step, referred to in patent claims for interactive voice response system, was controlled solely by called number.

[52] Patents 101(2)
291k101(2) Most Cited Cases

"Demographic conditions," referred to in patent claim for interactive voice response system, meant conditions used to limit call based on caller's geographic area.

[53] Patents 101(2)
291k101(2) Most Cited Cases

"Means for directly forwarding," called for in patent claim for interactive voice response system, was limited to disclosed structures which specifically performed function of directly forwarding call from remote terminal to live operator-attended terminal when remote terminal from which caller was calling was not technically capable of digitally providing data. 35 U.S.C.A. § 112.

[54] Patents 101(2)
291k101(2) Most Cited Cases

"First response unit means," called for in patent claims for interactive voice response system, referred to audio response units.

[55] Patents 101(2)
291k101(2) Most Cited Cases

"Qualification means," called for in patent claim for interactive voice response system, was limited to disclosed structures which specifically performed function preliminarily qualifying callers from remote terminals for connection to interface processors, and software required to perform said qualifying. 35 U.S.C.A. § 112.

[56] Patents 101(2)
291k101(2) Most Cited Cases

"Second response unit means for receiving calls in a second call mode," called for in patent claim for interactive voice response system, meant call mode, such as 900 call mode or area code mode, other than 800 call mode.

[57] Patents 165(4)
291k165(4) Most Cited Cases

Whether preamble imposes additional limitation on patent claim depends on whether it is structural or

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mere statement of purpose or use of invention.

[58] **Patents 101(2)**
291k101(2) Most Cited Cases

"Means for processing calls in an interface format," called for in patent claim for interactive voice response system, was limited to disclosed structures which specifically performed that function. 35 U.S.C.A. § 112.

[59] **Patents 101(2)**
291k101(2) Most Cited Cases

"Memory means for storing caller cues and use indications," called for in patent claim for interactive voice response system, meant computer hardware that stored questions or prompts which were given to caller.

[60] **Patents 101(2)**
291k101(2) Most Cited Cases

"Means for selecting a current caller cue," called for in patent claim for interactive voice response system, was limited to disclosed structures and associated software which specifically performed function of selecting current caller cue from memory under control of identification signals and use indications. 35 U.S.C.A. § 112.

Patents 328(2)
291k328(2) Most Cited Cases

4,930,150, 5,128,984, 5,255,309, 5,351,285, 5,561,707, 5,684,863. Cited.

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CONCLUSIONS OF LAW REGARDING PATENT CLAIM CONSTRUCTION

LOWELL A. REED, Jr., Senior District Judge.

Ronald A. Katz ("Katz") is the inventor in a large body of patents dealing with telephonic interactive voice applications. The plaintiffs, Ronald A. Katz Technology Licencing, L.P. and MCI Telecommunications Corporation, filed this patent infringement suit against AT & T Corporation, AT & T Universal Card Services Corporation, and AT & T American Transtech, Inc., alleging that the defendants are infringing a number of Katz's patents. In total, over 400 patent claims are at issue in this lawsuit. Because of the complexity and size of the case, the Court ordered that the parties designate a set of approximately seventeen claims to be construed at a *Markman* hearing. The plaintiffs designated twenty claims, including Claims 33, 44, 93, 104, 117, and 192 of the 5,561,707 patent (the '707 patent), Claims ***589** 49, 50, 65, 79, 171, and 190 of the 5,684,863 patent (the '863 patent), Claim 51 of the 5,255,309 patent (the '309 patent), Claim 15 of the 4,930,150 patent (the '150 patent), Claims 17, 20, 24, and 77 of the 5,351,285 patent (the '285 patent), and Claims 4 and 15 of the 5,128,984 patent (the '984 patent).

A *Markman* hearing was held from through June 4, 1999, in which the parties presented expert testimony and oral argument as to the proper construction of the disputed claim language in the twenty claims at issue. The parties also submitted a series of briefs and proposed claim constructions to the Court, all of which were considered by this Court in making the claim constructions that follow. On each claim term to be construed, the parties have submitted many arguments and have pointed to many portions of the intrinsic and extrinsic record in their briefs, in their proposed claim constructions, and in their oral presentations. While the Court has considered all of the arguments and citations of the parties, I may not reiterate all of them in full for each claim term.

I. THE LAW OF PATENT CLAIM CONSTRUCTION

In general, a patent must describe the scope of the patentee's invention so as to "secure to [the patentee] all to which he is entitled, [and] to apprise the public of what is still open to them." *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 373, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996) (internal quotation omitted). This is accomplished through the specification of the patent, which should describe the invention in clear terms so that a person in the art of the patent may make and use the invention, and the claims of the patent, which should "particularly poin[t] out and

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distinctly clai[m] the subject matter which the applicant regards as his invention." 35 U.S.C. § 112.

[1][2] In *Markman v. Westview Instruments, Inc.*, the Supreme Court, affirming the Court of Appeals for the Federal Circuit, held that construction of patent claims is exclusively within the province of the court to determine as a matter of law. 517 U.S. at 372, 116 S.Ct. 1384. To complete the task of claim construction, a court may draw on the canons of construction that can be sifted from the decisions of the Court of Appeals for the Federal Circuit spanning before *Markman* and beyond. In construing the claims of a patent, a court should consider the claim language, the specification, and, if offered, the prosecution history, which are collectively considered intrinsic evidence of the meaning of the claim terms. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed.Cir.1995). As the public record before the Patent and Trademark Office ("PTO") upon which the public is entitled to rely, the intrinsic evidence is the most important source for determining the meaning of claim terms. *See Vitronics Corporation v. Conceptronic, Inc.*, 90 F.3d 1576, 1582, 1583 (Fed.Cir.1996). Under some circumstances, a court may also consult evidence extrinsic to the patent, such as technical dictionaries or expert testimony as to how those skilled in the relevant art under consideration would interpret the claims. *Id.*

A. CLAIM LANGUAGE

[3] Because the scope of the rights conveyed to the patentee is defined by the claims, claim construction "begins and ends in all cases with the actual words of the claim." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed.Cir.1998). In construing the terms of a claim, "the focus is on the objective test of what one of ordinary skill in the art at the time of the invention would have understood the term to mean." *Markman*, 52 F.3d at 987. "Absent a special and particular definition created by the patent applicant, terms in a claim are to be given their ordinary and accustomed meaning." *Renishaw*, 158 F.3d at 1249.

***590** [4] Unless otherwise compelled, a court should give full effect to the ordinary meaning of claim terms, even if the terms are broad. *See Johnson Worldwide Associates, Inc. v. Zebco Corporation*, 175 F.3d 985, 989 (Fed.Cir.1999). "General descriptive terms will ordinarily by given their full meaning; modifiers will not be added to broad terms standing alone." *Id.*

[5] The specification, the prosecution history, and in some situations the extrinsic evidence may confirm the ordinary meaning of the claim terms or may provide a special meaning for the claim terms. *See Renishaw*, 158 F.3d at 1248. Thus, once a court has determined the ordinary meaning of the claim terms, it must also consider the specification and prosecution history to determine if the patentee used any terms in a manner inconsistent with their ordinary meaning. *See Vitronics*, 90 F.3d at 1582.

B. SPECIFICATION

[6][7][8][9] While terms are generally given their ordinary meaning, "[c]laims must be read in view of the specification, of which they are a part." *Markman*, 52 F.3d at 979; *see also Phonometrics, Inc. v. Northern Telecom Inc.*, 133 F.3d 1459, 1466 (Fed.Cir.1998)("Although claims are not necessarily restricted in scope to what is shown in a preferred embodiment, neither are the specifics of the preferred embodiment irrelevant to the correct meaning of claim limitations."). The relationship between the claims and the specification is illustrated by the following pair of claim construction canons: "(a) one may not read a limitation into a claim from the written description, but (b) one may look to the written description to define a term already in a claim limitation, for a claim must be read in view of the specification of which it is a part." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed.Cir.1998). While additional limitations may not be imported into a claim from the specification, a court may construe a limitation specifically recited in a claim in light of the specification. *See Phonometrics, Inc. v. Northern Telecom Inc.*, 133 F.3d 1459, 1466 (Fed.Cir.1998). Thus, in order to inject a definition into a claim from the written description, the claim must explicitly contain a term in need of definition. *See Renishaw*, 158 F.3d at 1248, 1252 (noting that passages referring to the preferred embodiment cannot be read into the claim without some "hook"). Further, claim terms should not be narrowed by the content of the specification "unless the language of the claims invites reference to those sources." *Johnson Worldwide*, 175 F.3d 985, 990 (noting that there "must be a textual reference in the actual language of the claim with which to associate a proffered claim construction").

[10] The *Johnson Worldwide* court noted two specific situations in which a claim term may be given a definition other than its ordinary meaning: (1) if a patentee chooses to be his or her own lexicographer by explicitly setting forth the definition for a claim term, or (2) if "the terms chosen by the

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patentee so deprive the claim of clarity that there is no means by which the scope of the claim may be ascertained from the language used." 175 F.3d at 990. In these situations, reference should be made to the specifications to determine the meaning of the claims.

Because a patentee is free to be his own lexicographer, the specifications may serve as dictionary for certain terms in the claims. *Markman*, 52 F.3d at 979-80. However, in order for a patentee to assign a special definition to a claim term, he or she must do so clearly in the specification. *Markman*, 52 F.3d at 980; *see also Renishaw*, 158 F.3d at 1249 (noting that a "patentee's lexicography must, of course, appear 'with reasonable clarity, deliberateness, and precision' before it can affect the claim") (quoting *In re Paulsen*, 30 F.3d 1475, 1480 (Fed.Cir.1994)). "Without an express intent to impart a novel meaning to claim terms, an inventor's claim terms ***591** take on their ordinary meaning." *York Products, Inc. v. Central Tractor Farm & Family Center*, 99 F.3d 1568, 1572 (Fed.Cir.1996); *see also Vitronics*, 90 F.3d at 1582 ("Although words in a claim are generally given their ordinary and customary meaning, a patentee may choose to be his own lexicographer and use terms in a manner other than their ordinary meaning, as long as the special definition of the term is clearly stated in the patent specification or file history."). Thus, if a term is used in a variety of ways by the patentee in the specification, this may be indicative of the breadth of the term, rather than a limited definition. *See Johnson Worldwide*, 175 F.3d 985, 990-91 (distinguishing *Laitram Corp. v. Morehouse Industries, Inc.*, 143 F.3d 1456, 1463 (Fed.Cir.1998) on the ground that in that case a narrow interpretation was compelled because of unambiguous language in the specification made clear that the claim language had only one interpretation).

As for the second situation discussed in *Johnson Worldwide*, while a court generally construes claim terms consistent with their common meaning, a "common meaning, such as one expressed in a relevant dictionary, that flies in the face of the patent disclosure is undeserving of fealty." *Renishaw*, 158 F.3d at 1250. Also, a court may also resort to the specifications if a claim term lends itself to several common meanings; in such a situation "the patent disclosure serves to point away from the improper meanings and toward the proper meaning." *Renishaw*, 158 F.3d at 1250.

C. PROSECUTION HISTORY

[11][12] The third source of intrinsic evidence that a court may consider in understanding the meaning of the claims is the prosecution history. However, "[a]lthough the prosecution history can and should be used to understand the language used in the claims, it too cannot 'enlarge, diminish, or vary' the limitations in the claims." *Markman*, 52 F.3d at 980 (quoting *Goodyear Dental Vulcanite Co. v. Davis*, 102 U.S. 222, 227, 12 Otto 222, 26 L.Ed. 149 (1880)). A court also may consider the prior art cited in the prosecution history, which may contain clues as to what the claims do not cover. *See Vitronics*, 90 F.3d at 1583.

[13][14] If a patentee takes a position before the PTO, such that a "competitor would reasonably believe that the applicant had surrendered the relevant subject matter," the patentee may be barred from asserting an inconsistent position on claim construction. *Cybor Corp. v. FAS Technologies, Inc.*, 138 F.3d 1448, 1457 (Fed.Cir.1998); *see also Cole v. Kimberly-Clark Corporation*, 102 F.3d 524, 531 (Fed.Cir.1996) (holding that the patentee was estopped from arguing that her "perforation means" encompassed "ultrasonic bonded seams" after she distinguished references that contained such seams). If a patentee distinguishes a reference on multiple grounds to the PTO, any one of these may indicate the correct construction of a term. *See Gentry Gallery, Inc. v. Berkline Corporation*, 134 F.3d 1473, 1477 n. * (Fed.Cir.1998). However, "[u]nless altering claim language to escape an examiner rejection, a patent applicant only limits claims during prosecution by clearly disavowing claim coverage," that is, by making a statement that concedes or disclaims coverage of the claims at issue based on a piece of prior art. *York Products*, 99 F.3d at 1575.

D. EXTRINSIC EVIDENCE

[15][16][17] A court may, in its discretion, consider extrinsic evidence in order to correctly understand and define the language of the claims. *See Markman*, 52 F.3d at 980. However, "[e]xtrinsic evidence is to be used for the court's understanding of the patent, not for the purpose of varying or contradicting the terms of the claims." *Markman*, 52 F.3d at 981; *see also Vitronics*, 90 F.3d at 1584. Extrinsic evidence may be consulted if the court is not familiar with the terminology of art in which the patent is written, but it should not be ***592** consulted to clarify ambiguity in claim terms. *See Markman*, 52 F.3d at 986. "Indeed where the patent documents are unambiguous, expert testimony regarding the meaning of a claim is entitled to no weight." *Vitronics*, 90 F.3d at 1584.

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E. MEANS PLUS FUNCTION LIMITATIONS

Paragraph 6 of section 112 of 35 U.S.C. provides that:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

This provision of the patent statute permits a patentee to write a limitation in a combination claim as a means for performing a function without reciting structure, material, or acts in the limitation. *See* Valmont Industries, Inc. v. Reinke Mfg. Co., Inc., 983 F.2d 1039, 1042 (Fed.Cir.1993). A patentee who invokes this drafting tool is required, however, to describe in the patent specification some structure which performs the specified function. *See* Valmont, 983 F.2d at 1042.

[18] If a patentee uses the word "means" in a claim, a presumption arises that he or she used the word to invoke § 112, ¶ 6. *See* Rodime PLC v. Seagate Technology, Inc., 174 F.3d 1294, 1302 (Fed.Cir.1999). There are two ways this presumption may be rebutted: (1) if a claim term uses the word "means" but recites no function which corresponds, or (2) if the claim recites a function but also recites sufficient structure or material for performing the claimed function. *See* Rodime, 174 F.3d 1294, 1302. It is also possible that a claim limitation that does not recite the word "means" may be construed under § 112, ¶ 6, despite a presumption to the contrary. *See* Cole v. Kimberly-Clark Corporation, 102 F.3d 524, 531 (Fed.Cir.1996) (citing Raytheon Co. v. Roper Corporation, 724 F.2d 951, 957 (Fed.Cir.1983)).

[19] Even if a mechanism is defined in functional terms, such as a "filter," "brake", "clamp," or "detent mechanism," or if it does not call to mind a single well-defined structure, it may not be subject to means-plus- function analysis. *See* Greenberg v. Ethicon Endo-Surgery, Inc., 91 F.3d 1580, 1583 (Fed.Cir.1996) (noting that "[d]ictionary definitions make clear that the noun 'detent' denotes a type of device with a generally understood meaning in the mechanical arts, even though the definitions are expressed in functional terms" and that "[i]t is true that the term 'detent' does not call to mind a single well-defined structure, but the same could be said of other commonplace structural terms such as "clamp" or "container" "). In addition, a structural term need not connote a precise physical structure to those of ordinary skill in the art to avoid a means-plus-function analysis, as long as it conveys a variety of structures that are referred to by that term. *See* Personalized Media Communications, LLC v. International Trade Commission, 161 F.3d 696, 704-705 (Fed.Cir.1998) (noting that "detector" was not a generic structural term such as "means," "element," or "device" nor a coined term such as "widget" or "ram-a-fram" in deciding that use of the term "digital detector" did not subject the limitation to § 112, ¶ 6 analysis). The critical inquiry is "not simply that a [mechanism] is defined in terms of what it does, but that the term, as the name for structure, has a reasonably well understood meaning in the art." Greenberg v. Ethicon Endo-Surgery, Inc., 91 F.3d 1580, 1583 (Fed.Cir.1996).

Once the court has determined that a claim limitation is written in means plus function form, the court must define what the "means" are in the claim. The first step is to determine the function that the ***593** claimed means performs. *See* Rodime, 174 F.3d 1294, 1302. The claim language must link the term "means" to a function or the limitation is not subject to 112, ¶ 6. *See* York Products, Inc. v. Central Tractor Farm & Family Center, 99 F.3d 1568, 1574 (Fed.Cir.1996). Next, the court must determine what structure, material, or acts disclosed in the specification correspond to the word "means." *See* Chiuminatta Concrete Concepts, Inc. v. Cardinal Industries, Inc., 145 F.3d 1303, 1308 (Fed.Cir.1998).

[20][21] In determining the structure disclosed in the specification that corresponds to the means, the court should be wary of importing excess limitations from the specification. For example, if a structure is defined in the specification in a way unrelated to the recited function in the means-plus- function clause, those additional aspects of the structure should not be read as limiting the scope of the means clause. *See* Chiuminatta, 145 F.3d at 1308-1309 (construing a patent for an apparatus and method for cutting concrete, the court held that because the function that corresponded to the means in the limitation was supporting the surface of the concrete, structural aspects of the skid plate in the preferred embodiment that did not perform this particular function were not to be read as limiting the scope of the means clause). In addition, in construing means plus function claims, generally a court should not import a function of a working device or a preferred embodiment into the claims as part of the "means" if such a function is not part of the function recited in the claims. *See* Rodime, 174 F.3d 1294, 1305; *see also* Constant v.

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Advanced Micro-Devices, Inc., 848 F.2d 1560, 1571 (Fed.Cir.1988) ("Although the specification may aid the court in interpreting the meaning of disputed language in the claims, particular embodiments and examples appearing in the specification will not generally be read into the claims.").

II. CONSTRUCTION OF THE TWENTY CLAIMS PRESENTED AT THE *MARKMAN* HEARING

The twenty patent claims presented to the Court for construction at the *Markman* hearing may be categorized into the following groups: (1) Analysis Control System Claims, including Claim 51 of the '309 patent, Claims 33, 104, 117 and 192 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent, (2) Claims Involving Products Carrying Participation Numbers, including Claims 44 and 93 of the '707 patent and Claims 79 and 190 of the '863 patent, (3) Conditional Format Claims, including Claim 15 of the '150 patent and Claims 17, 20, 24, 77 of the '285 patent, and (4) Claims from the '984 patent, including Claims 4 and 15.

A. ANALYSIS CONTROL SYSTEM CLAIMS

The first set of claims, the Analysis Control System Claims, come from the '707, '863, and '309 patents. The text and figures of the specifications to these three patents are identical, so references to the specification in one patent are equally applicable to analysis of a term appearing in a claim in another of the three patents. The text of the analysis control system claims at issue is provided in the Appendix to this Memorandum.

In general, the '707, '863, and '309 patents describe a system which interfaces callers at remote terminals through a telephone network to provide voice prompts to the callers so that they can provide information to the system. The information from the callers may be stored in the system for processing. The content of the prompts provided by the system to the callers and the type of processing performed on the information provided by the callers is determined by a format, designed to implement, for example, an auction sale or a contest.

1. "Communication Facility"

[22] The parties have asked the Court to construe the term "communication facility." ***594** [FN1] The plaintiffs argue that although the term does not have a common meaning to one of ordinary skill in the art, [FN2] the meaning is clear from the claim language. The plaintiffs contend that because the purpose of the communication facility in the claims is to connect callers to the interactive voice application ("the Katz system"), the kind of communication facility is inconsequential and the Court should construe the term to mean "any telephone network that enables callers to make calls." (Pls.' Brief at 44-45).

FN1. The parties agree that the term "telephonic [or 'telephone'] communication system" is synonymous with "communication facility" and thus should be construed the same. The Court finds no reason in the claim language, specifications, or prosecution history of the patents which contain these terms to construe the two terms differently.
In addition to Claim 51 of the '309, the term "communication facility" or "telephonic [or 'telephone'] communication system" appears in the following claims: Claims 33, 44, 93, 104, 117 and 192 of the '707 patent, Claims 49, 50, 65, 79, 171, and 190 of the '863 patent, Claim 10 of the '309 patent, Claims 17, 20, 24, and 77 of the '285 patent, and Claim 15 of the '984 patent. There being no indication to the contrary, the Court concludes that these terms have one meaning across all the patent claims at issue in the *Markman* hearing.

FN2. Both Mr. Morganstein, the expert for the plaintiffs, and Professor Larky, one of the experts for the defendants, testified that a person of ordinary skill in the art of interactive voice response systems would have had at least a Bachelor's degree in a scientific or engineering field, such as physics, electrical engineering, or computer science, and at least two years experience working in the field of computer telephony. (Transcript volume 1 at 77-78; volume 3 at 39).

The defendants attack this proposed construction of communication facility and argue that the Court should construe the term as requiring that (1) the communication facility comprise the entire Public Switched Telephone Network ("PSTN") [FN3] and (2) the Katz system must be operated only outside the PSTN or communication facility. To support their argument that the communication facility comprises the entire PSTN, the defendants point to particular

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language in the specifications that they contend supports such a construction. First, the defendants point to Column 3 of the '707 patent at line 13, which provides that "[i]n the disclosed embodiment, the remote terminals T1 through Tn represent the multitude of conventional telephone terminals that are coupled to a communication facility C which may take the form of a comprehensive public telephone system for interconnecting any associated terminals T1-Tn." Because the specification indicates that the communication facility has the ability to connect *any* associated terminals (such as telephones), the defendants argue that the communication facility must include the entire PSTN. Similarly, the defendants argue that Katz defined communication facility as the entire PSTN in line 63 of Column 4 of the '707 patent, which provides that "DNIS capability is a function of the communication facility C (composite telephone system)." The defendants maintain that these passages of the specification indicate that the communication facility should be construed to mean the entire PSTN.

FN3. Professor Larky defined the PSTN as the comprehensive public telephone system which "includes the operations of the various local exchange carriers (such as Bell Atlantic), and interexchange (long distance) carriers, such as AT & T and MCI." (Expert Report of Larky at 14). Although, the Court did not need to draw on expert testimony to construe the meaning of the term "communication facility," reference to the expert's report to understand the meaning of the term PSTN is essential to understanding the defendants' argument.

The plaintiffs argue that the passages relied on by the defendants do not support their construction and that the specification indicates a contrary definition of "communication facility." In Column 17 of the '707 patent, Katz states that callers to his system could be billed through the "pay-to-dial network." The plaintiffs argue that this indicates that "communication facility" may comprise any part of the ***595** PSTN, including the pay-to-dial network, that allows calls to be made by a caller to the Katz system and does not require that it comprise the entire PSTN. In addition, the plaintiffs contend that the prosecution history supports this construction. In a Preliminary Amendment dated January 10, 1986 in the prosecution of the '299 patent, Katz amended his claims to replace the term "public communication facility" with the term "communication facility." (Ex. 26). Katz also added a claim during the prosecution of the '299 patent, claim 15, which provided: "A system according to claim 1 wherein said communication system comprises a public communication system." (Ex. 26). By altering his claims, the plaintiffs argue, Katz clearly did not limit his claims to *always* require use of the entire PSTN.

This Court concludes that the claim language does not shed much light on the scope of the communication facility; however, there is no indication from claim language itself that the communication facility must include the entire PSTN. The specification is more helpful in determining the scope of the term at issue. In Column 3, lines 55-59 of the '707 patent, Katz states that "[i]n the illustrative embodiment of the system, the communication facility C comprises a public telephone network." This indicates that the communication facility may, but is not required to involve the entire PSTN. In addition, the prosecution history of '299 patent cited by the plaintiffs, in which Katz removed the word "public" from modifying "communication facility," is consistent with this indication. The references to the specification made by the defendants do not undermine this reading of the claim language and specification and do not lend support to the defendants' proposed construction of this term. Thus, I conclude that in light of the claim language, specifications, and prosecution history presented by the plaintiffs, the term "communication facility" does not require the involvement of the entire PSTN or thus, all of its elements and processes.

To support their argument that "communication facility" is defined in the patents such that the Katz system must be operated only *outside* the PSTN or communication facility, the defendants point to the language of the preamble and claim limitations. The parties agree that because the terms "communication facility" and "analysis control system," which initially appear in the preamble, are referred to in the claim limitations, these terms should be considered as limitations in the claims. *See* *Gerber Garment Technology, Inc. v. Lectra Systems, Inc.*, 916 F.2d 683, 689 (Fed.Cir.1990). The preamble provides for "[a]n analysis control system for use with a communication facility;" the defendants contend that this language, particularly the word "with," indicates that the Katz system, the analysis control system, is necessarily outside of the network. Further, the defendants argue that because the preamble indicates that the communication facility provides call data signals to the Katz system, this indicates that Katz was not referring to the internal routing signals that

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occur inside the telephone network.

Turning to the language of the claim limitations, the defendants point out that Katz used the phrase "coupled to said communication facility," which they argue indicates that the Katz system is something distinct from the communication facility because it is "coupled to" it. The defendants also contend that the limitation "interface structure coupled to said communication facility ... including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data and said called number identification data (DNIS) to identify one from a plurality of called numbers" indicates that the interface structure cannot be a switch inside the PSTN, because switches *send* ***596** DNIS, not receive it. [FN4] This, the defendants argue, is further proof that the Katz system cannot include any elements or processes which are inside the PSTN.

FN4. This limitation is not present in Claim 51 of the '309 patent, but it and similar limitations appear in other claims in which the term "communication facility" is used. *See, e.g.,* Claim 171 of the ' 863 patent (dependent on Claim 93 of the '863).

In addition, the defendants refer the Court to Figure 1 in the specification. First, the defendants argue that the Katz system is represented as a "dead-end" or the place at which a call terminates, not as a mechanism by which calls are connected from one person to another, as is the function of the PSTN. Second, the defendants argue that pursuant to the Code of Federal Regulations, if an aspect of the invention is represented in the figure as a rectangular box, it indicates that that aspect is not essential to the understanding of the invention, citing 37 C.F.R. § 1.83(a). Thus, the defendants argue, the fact that the communication facility is represented in the figure as an empty box lends support to their position that the Katz system must be operated only outside the network.

Finally, the defendants point to the specification of the '707 patent at Column 6 at line 14, which provides that "individual callers would use the remote terminals T1-Tn to contact the central station D through the communication facility," as indicating that by using the word "through," Katz indicated that the Katz system must be operated only outside the PSTN.

The plaintiffs argue that the claim language is silent as to whether the Katz system must function only "inside" or "outside" the network. Further, the plaintiffs argue that there is nothing in the specification that requires that the Katz system function only outside the network. The plaintiffs maintain that although the communication facility is represented in Figure 1 as an empty box, certain parts that the defendants would consider to be "inside" the PSTN, such as the remote terminals and customer billing, are split out and shown as separate boxes in Figure 1. Thus, the plaintiffs contend that if customer billing and the remote terminals can be shown as separate empty boxes and still be "inside" the PSTN, there is no basis in Figure 1 for construing the Katz system, which is also represented by separate boxes, as "outside" the PSTN.

The Court concludes that there is no basis in the claim language, the specifications, or in Figure 1 to construe the term "communication facility" to mean that the Katz system must be operated only outside the communication facility. It appears that the essence of the defendants' argument here is that the Katz system cannot run on any of the equipment that is part of the communication facility, and thus, is "outside" of the communication facility. The Court is not persuaded that the words "for use with," "through" or "coupled to" indicates that the Katz system must be operated only outside the communication facility. The words "with," "through," and "coupled to" connote some type of relationship between two things; however, none of these terms means that the two things in the relationship cannot be considered part of the same system or entity.

Finally, the defendants argue that, claim language and specification aside, Katz clearly limited his invention to a system only existing outside the communication facility in his representations to the PTO during the prosecution of his patents. The defendants point to comments by Katz during the prosecution of the '707 patent regarding patents to DeBruyn, Riskin, Comella, and Daudelin. Specifically, the defendants point out that in an Amendment dated August 31, 1995, Katz stated that he amended his claim to recite "that processing of at least certain of the data developed by the terminals and the calling number identification data occurs in the Applicant's system" and that "[n]either DeBruyn nor Riskin teach this aspect of the Applicant's system, also neither patent ***597** teaches calling number identification data provided automatically by a communication system (for example, ANI or like signals)." (Ex. 51).

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In addition, the defendants point out that in the same Amendment, Katz noted in part that Comella's system "replaces the function of an operator for certain types of calls, for example, collect calls, person-to-person calls, charge-to- third number calls and so on" and that the patent to Comella "is somewhat of background interest for its interface aspects." (Ex. 51). As for the patent to Daudelin, the defendants point out that Katz described it as "generally directed to an interface arrangement for reducing the load on telephone operators." (Ex. 51). Apparently, the defendants contend that if Katz had contemplated that his system could have operated inside the PSTN, he should have said a lot more than he did to adequately distinguish his invention from the Daudelin and Comella patents, which were inventions that were operated by the PSTN.

Whether Katz complied with his obligations before the PTO, however, is a question for another day; the question before the Court is whether Katz made any statements to the PTO that limited the scope of his claims. Considering the passages of prosecution history flagged by the defendants, the answer to that question is no: The Court concludes that the statements by Katz regarding these patents do not constitute a representation from him to the PTO that his invention could be operated only "outside" the communication facility.

Further, the defendants point to statements made by Katz to the PTO in the September 19, 1994 Supplemental Information Disclosure Statement ("IDS") during the prosecution of the '575 patent, which occurred while the application of the '707 patent was still being prosecuted. Specifically, the defendants point to a passage in which Katz referred to a patent by DeBruyn and stated in part that the patent to DeBruyn "discloses a lottery system that is integral with the 'Telephone Company,' " and that in Katz' system, "the 'Telephone Company' ('a communication facility') simply provides an interface, the lottery system being a separate and distinct capability." (Ex. 41). However, taking the statements highlighted by the defendants in context, Katz points out differences between his system and the DeBruyn system including that in Katz system the caller must enter "lottery and identification data," while in the DeBruyn system, the caller need not enter such information because the system is run inside the "Telephone Company" where the callers' telephone number is already known. These statements highlight that the Katz system requires that a caller enter certain data, which is not required by the DeBruyn system; the statements do not limit the physical or geographic location where the Katz system can or cannot operate.

Similarly, the defendants refer to another piece of prosecution history in which Katz discussed a patent to DeBruyn for a telephonic lottery system. (Ex. 46). In the September 30, 1994 IDS in the prosecution of the '120 patent, [FN5] Katz stated that DeBruyn was distinct from his system which received identification from a caller because the it was "integrated with the composite telephone system which could identify the subscriber's telephone number." The Court concludes that the statements of Katz in the September 19, 1994 Supplemental IDS and the September 30, 1994 IDS do not restrict or limit the term "communication facility" to mean that the Katz system must be operated only outside of it.

> FN5. The '120 patent is related to the patents-in-suit; the defendants cite to this prosecution history because the claims at issue contain language regarding the communication facility which is similar to the patents before the Court. (Defs.' Brief at 34 n. 20).

The defendants argue that Katz also distinguishes his system from the routing and connection of telephone calls, which ***598** are integral functions of a telephone company, thereby establishing that his system was to operate only outside the network. The defendants point to a statement made by Katz regarding a patent to Riskin in the prosecution of the '075 patent. (Ex. 40). In the Preliminary Amendment dated July 17, 1990, Katz stated that "[r]ecognizing that the Riskin patent discloses the utilization of ANI and DNIS signals to accomplish telephone routing, it is respectfully submitted that applicant's system involves entirely different philosophical considerations and structure." The defendants contend that because the Riskin patent was a system that was inside the telephone network, this statement by Katz indicates that his system was to be operated outside the PSTN. Similarly, the defendants argue that Katz distinguished his invention during the prosecution of the '929 patent [FN6] from a patent to Riskin by stating that his invention was outside the PSTN. (Ex. 37). In the Amendment dated August 1, 1990, Katz noted that in the Riskin patent, "functions are involved that are completely distinct from applicant's system.... Specifically, Riskin does not disclose an interface telephone system but rather discloses a connection system." The Court concludes that in these statements, however, Katz is

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discussing functional differences between the Riskin system and his system, not differences in the physical or geographic location of the elements of the systems.

FN6. The '929 patent is a direct descendant of the '299 Application, from which all the patents-in-suit descend.

Essentially, the defendants are attempting in their arguments regarding "communication facility" to put a non-infringement rabbit in their hat at the claim construction stage of the case; in their arguments, they expressly seek to include any and all of their equipment, wires, switches, computers, trunks, lines, databases, and so on in the definition of "communication facility" and then establish that the Katz system cannot by definition include any of those things or run on any of that equipment because his system must be "outside" the communication facility. The result of adopting such reasoning would be to restrict the definition of "communication facility" on the basis of who owned the computer or switch on which the Katz system was running or on the basis of the physical or geographic location of the particular computer or switch. The plain words of the patents will not support such a restricted definition.

Based on the foregoing inspection of the claim language, specification, and prosecution history, the Court construes the term "communication facility" in the Katz patents to mean: that part of a telephone network that enables a caller to connect to the Katz system. The Court concludes that there is no support for a construction of "communication facility" to require that the Katz system be operated only outside the entire PSTN nor that the "communication facility" encompass the elements or processes of the entire PSTN.

2. Application of Means-Plus-Function Analysis

The analysis control system claims contain several limitations that contain a "structure" or "means" term, such as "interface structure," "voice generator structure," and "means to provide call data signals representative of data developed by said remote terminals." While the parties agree that some of these terms are subject to means-plus-function analysis under 35 U.S.C. § 112, ¶ 6, the plaintiffs dispute the application of such analysis to other terms.

a. "Interface Structure"

[23] The first of these terms the parties wish the Court to construe is "interface structure." [FN7] The claim limitations in ***599** which this term appears read "an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication." In some of the claims, the limitation goes on to provide that the interface structure includes "means to provide caller data signals representative of data relating to said individual callers developed by said remote terminals." [FN8] Other claims contain limitations which further provide that the interface structure includes means "for receiving said calling number identification data." [FN9]

FN7. The term "interface structure" appears in the following claims under consideration at the *Markman* hearing: Claim 51 of the '309 patent, Claims 33, 104, 117 and 192 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent.

FN8. Claims which include this or similar language are Claims 51 of the '309 patent, Claims 104 and 117 of the '707 patent, and Claims 49, 65, and 171 of the '863 patent.

FN9. Claims which include this or similar language are Claims 104, 117, and 192 of the '707 patent and Claims 49, 65, and 171 of the ' 863 patent.

The dispute between the plaintiffs and the defendants centers around whether "interface structure" is subject to means-plus-function analysis under 35 U.S.C. § 112, ¶ 6. The plaintiffs maintain that the term does not implicate § 112, ¶ 6 and should be construed to mean "a hardware device with associated software that establishes an interactive connection between a caller's telephone and a computer system." (Pls.' Brief at 50). The plaintiffs argue that under *Personalized Media Communications, LLC v. International Trade Commission*, 161 F.3d 696, 704-705 (Fed.Cir.1998), a term that is defined in terms of its function or that does not bring to mind one well-defined structure is not necessarily subject to means-plus-function analysis. In *Personalized Media*, the Court of Appeals for the Federal Circuit held that the term "digital detector" was not subject to means-plus-function analysis because it conveyed to one of ordinary skill in the art "a variety of structures known

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as detectors." *Id.* at 705. The plaintiffs argue that the term "interface structure" is akin to "digital detector" in that it is a sufficient recitation of structure so as to avoid the application of means-plus-function analysis. The plaintiffs argue that a specific set of structures corresponding to "interface structure" was known to those of ordinary skill in the art at the time of the prosecution of the Katz patents.

The defendants argue that the term "interface structure" is written in functional language, fails to sufficiently connote structure to those of ordinary skill in the art, and as such, it subject to analysis under § 112, ¶ 6. The defendants contend that Katz simply used the term "structure" instead of "means" to attempt to avoid the application of § 112 ¶ 6. The defendants maintain that "interface structure" is a generic term which does not inform a person of ordinary skill in the art what structure is being conveyed by the term.

[24] Because the term "interface structure" is not drafted in "means for" form, the Court presumes that it is not subject to the requirements of § 112 ¶ 6. *See Mas-Hamilton Group v. LaGard, Inc.*, 156 F.3d 1206, 1213 (Fed.Cir.1998). The critical factor in determining whether a term in a limitation which does not invoke "means for" language is subject to means-plus- function analysis despite the presumption to the contrary is whether the term brings to mind a set of structures to those of ordinary skill in the art, and not whether the term is written in functional language. *See Personalized Media*, 161 F.3d at 704-705. To determine whether this term would connote sufficient structure to those of ordinary skill in the art, this Court must refer to references in the computer telephone field contemporary with the prosecution of the Katz patents. *See Greenberg*, 91 F.3d at 1583 (consulting dictionaries to determine that the term "detent" denoted a device generally understood to those in the mechanical arts).

***600** In an article in the AT & T Technical Journal regarding the Conversant 1 Voice System, [FN10] "trunk interface units" are described as connecting incoming trunks from a central office in the telephone network, and "line interface units" are described as initiating or receiving calls over ordinary telephone lines. (Ex. 366). In an 1985 article entitled "The AT & T Multi- Mode Voice SystemsFull Spectrum Solutions for Speech Processing Applications," the authors refer to "telephone interface units (either line or trunk circuits)" as being a component of a basic system for speech processing applications using the telephone network and centralized databases. (Ex. 358). Other references in the record indicate that "interface structure" connoted structure to those of ordinary skill in the art: Exhibit 355, an article regarding Periphonics Voicepac, describes a particular brand of device used as an interface; Exhibit 405, a 1986 article on the Conversant 1 Voice System, discusses the function of line and trunk interfaces; Exhibit 250, the 4,866,756 patent to Crane et al., incorporates a "telephone interface component" to transmit audio response signals; and Exhibit 235, the 4,797,911 patent to Szlam et al., incorporates "trunk interface units" into its customer account online servicing system.

FN10. The date of this article is unclear in the record, but there is some indication in the article that the manuscript was revised in 1986.

One technical dictionary cited by the plaintiffs was helpful in assisting the Court determine what "interface structure" meant to those in the art. In the *Dictionary of Computing and New Information Technology* by A.J. Meadows, et al. (1982), the term "interface" is defined as being "[u]sed as a general term to describe the connecting link between the two systems. Most frequently refers to the hardware and software required to couple together two processing elements in a computer system." (Ex. 481).

While the testimony of the experts at the *Markman* hearing is not as weighty as prior art and technical references in determining the state of the art at the time of the prosecution of the Katz patents, it is consistent with the above references in indicating that "interface structure" had meaning and brought to mind a set of structures to those in the field. *See* Morganstein Testimony, Transcript Volume 1 at 173, line 24 to 176, line 2 (testifying that the term "interface structure" would have had meaning to a person of ordinary skill in the art who had read the Katz patents and would have brought to mind a range of structures such a person could have used to build the Katz inventions); Larky Testimony, Transcript Volume 3 at 64 lines 12-15 (testifying that he recognized that the term "interface structure" referred to "some physical structure" but not a specific structure).

Based on the above references and expert testimony, the Court concludes that although the term "interface structure" is written in functional language, the limitation sufficiently connotes structure such that §

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112, ¶ 6 does not apply. That is, I conclude that, based on the cited prior art, references, and testimony of the experts at the *Markman* hearing, the term "interface structure" would have called to mind a specific set of structures to a person of ordinary skill in the art such that such a person would be able to build the Katz inventions.

Having concluded that the term "interface structure" is not subject to § 112, ¶ 6, the Court must construe the meaning of the term according to the regular rules for claim construction. The meaning of "interface structure" to those of ordinary skill in the art at the time has been discussed above. In addition, in Column 4, line 52 to Column 5 line 15 of the '707 patent, Katz discusses the function and components of the interface structure and states that "the interface 20 incorporates modems, tone decoders, switching mechanisms, DNIS and ANI capability (call data analyzer 20a) ***601** along with voice interface capability" and that the "interface 20 provides the connection of the first lines to a switch 21 which are in turn coupled to first function units, or processors PR1 to PRn." This description of the interface in the specification is consistent with the ordinary meaning of the term "interface structure" to those of skill in the art. Based on the foregoing, I construe the term "interface structure" in the Katz patents to mean "the hardware and software required to connect the processors upon which the Katz system is running to the communication facility such that information from the communication facility and the remote terminals may be provided to and received by the Katz system." For the claims listed in footnote 8, *supra,* the Court construes the term "interface structure" to also include the means to perform the specific function of providing caller data signals representative of data developed at the remote terminals. For the claims listed in footnote 9, *supra,* the Court construes the term "interface structure" to also include the means to perform the specific function of receiving calling number identification data.

b. "Means to Provide Caller Data Signals" and "Means to Receive Calling Number Identification Data"

[25] Some of the limitations beginning with the term "interface structure" contain terms drafted in "means for" language, including "means to provide caller data signals" in Claims 51 of the '309 patent, Claims 104 and 117 of the '707 patent, and Claims 49, 65, and 171 of the '863 patent, and means "to receive calling number identification data" in Claims 104, 117, and 192 of the '707 patent and Claims 49, 65, and 171 of the '863 patent. [FN11] Both sides agree that these terms are subject to means-plus- function analysis. The plaintiffs argue that the structure that corresponds to the "means" in "means to provide caller data signals" is the Interface 20 in Figure 1 or Interface 1A sub1 through 1A subN and 1B sub1 through 1B subN in Figure 9 of the '309, '707, and '863 patents. The plaintiffs argue that the structures in Figure 1 that correspond to the "means" in "means to receive calling number identification data" are the Interface (20) and the Call Data Analyzer (20a). The defendants argue that the "means" in both of these means- plus-function limitations corresponds to the structures referenced by the plaintiffs but also corresponds to the Automatic Call Distributor ("ACD").

FN11. Some of the claims contain slight variations on this language, but the Court concludes the meaning of the various phasing of this concept is the same.

The Court concludes that the phrases "means to provide caller data signals" and "means for receiving said caller number identification data" are written in "means for" form, do not recite sufficient structure in the claim language, and are subject to analysis under § 112, ¶ 6. According to the specification of the '707 patent at Column 4, lines 28-31, the ACD functions to "queue incoming calls for connection to a lesser number of lines." The ACD does not fulfill and is not necessary to the function of providing call data signals or receiving calling number identification data and thus does not correspond to the "means" in those limitations. The Court concludes that the structure disclosed in the patents that corresponds to the "means" in the "means to provide caller data signals" is the Interface 20. The Court concludes that the structures disclosed in the patents that correspond to the "means" in "means for receiving calling number identification data" are the Interface 20 and the Call Data Analyzer 20a.

c. "Voice Generator Structure"

[26] The term "voice generator" appears in several of the analysis control system claims at issue, and the limitations containing this term read "voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions ***602** to said individual callers." [FN12] The parties agree that the term "voice generator structure" is not subject to means-plus-function analysis because the term connotes a

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specific range of structures that correspond to the term to those of ordinary skill in the art. The Court concludes that the plain meaning of the term "voice generator" indicates a structure that can produce vocal sounds. The specification of the patents in which this term is found describes the voice generator structure as "a voice origination apparatus may prompt individual callers who (after qualification) provide select digital data to develop a record for further processing." Column 2 lines 4 to 8 of the '707 patent. The specification also provides that the voice generator is incorporated in the interface, Column 4, lines 55 to 58 of the '707 patent, and that "recorded voice messages prompt callers to provide data by actuating the alphanumeric buttons"on their telephones, Column 1, lines 45 to 47 of the '707 patent. Based on the term's ordinary meaning, the claim language, and the specification, the Court concludes that "voice generator" means: a device for generating vocal instructions or prompts to individual callers at the remote terminals.

FN12. The term "voice generator structure" is found in Claim 51 of '309, Claims 33, 104, 117, and 192 of the '707 patent, and Claims 65 and 171 of the '863 patent. In Claim 192 of the '707 patent, the limitation provides that the voice generator structure is also able "to prompt said individual callers to enter data."

d. "Record Structure"

[27] The term "record structure" begins limitations in many of the Analysis Control System Claims at issue; the limitation in Claim 51 of the '309 patent reads "record structure, including memory and control means, connected to receive said caller data signals from said interface structure for updating a file and storing digital caller data relating to said individual callers provided from said digital input means through said interface structure." [FN13]

FN13. The term "record structure" appears in the following claims: Claim 51 of the '309 patent, Claims 33, 104, 117, and 192 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent. The wording of the record structure limitations varies across these claims; however, all include "memory and control means" and the concept of receiving information about callers from the interface structure or the communication facility and then storing, updating, accessing, or testing that information. Thus, the definition of the term "record structure" will be the same across the claims at issue in which it appears.

The plaintiffs argue that "record structure" is not subject to means-plus- function analysis because the term connotes structure to those of ordinary skill in the art. Morganstein testified at the *Markman* hearing that a person of ordinary skill in the art who had read the Katz patents would have understood "record structure" to refer to a set of structures; Morganstein testified that the record structure would correspond to one of the building blocks of interactive voice applications, including processors, memory, and software. (Transcript volume 1 at 181-182). Larky did not disagree with Morganstein and testified that "record structure" would have connoted structure to those in the field. (Transcript volume 3 at 67-68). The plaintiffs also argue that the phrases "including memory" [FN14] and "connected to receive said caller data signals from said interface structure" are additional structural descriptions of record structure in the claims which support their position that the term does not implicate § 112, ¶ 6. The plaintiffs' proposed construction of this term is "a hardware device with associated ***603** software, including memory and control means, used to store information." (Pls.' Appendix at 132).

FN14. It appears that both sides agree that the term "memory" does not implicate § 112, ¶ 6. Morganstein testified at the *Markman* hearing that a person of ordinary skill in the art would have been aware of many kinds of "memory," such as RAM, tapes, cassettes, and disks. *See* Morganstein Testimony, Transcript volume 1 at 106. Thus, the Court construes the term "memory" according to its plain meaning as: computer hardware that stores information, such as disks, RAM, or tapes.

The defendants argue that "record structure" is subject to § 112, ¶ 6 because the term is defined by the function it performs--accessing a file and storing data--and because it lacks a sufficiently definite structure to those of ordinary skill in the art. The structures that correspond to this term, the defendants argue, are the Processing Unit 92, Memory 98 with storage cells C1 through Cn in Figure 4, and the required wiring to connect these structures together.

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The defendants argue that "record structure" also corresponds to the required software for performing the disclosed functions. The defendants contend that the only software programs disclosed in the specifications are in the context of the specific "formats" described by Katz, such as game shows, lotteries, and auctions. [FN15]

FN15. The defendants argued as well on other claim terms that the structures corresponding to the means in mean-plus-function limitations included software that was particularly programmed to carry out one of the seven formats disclosed in the specifications or to perform "statistical analysis to isolate a subset." In support of this argument, the defendants submitted the recent case of *WMS Gaming Inc. v. International Game Technology*, 184 F.3d 1339 (Fed.Cir.1999) after the close of the *Markman* hearing. Upon full consideration of the *WMS Gaming* case and the letters submitted to the Court by the parties regarding this issue, the Court concludes that the new decision by the Federal Circuit does not require that the software corresponding to the means in these limitations be specifically programmed to perform one of the seven formats disclosed in the specifications or statistical analysis to isolate a subset of callers or data.

Based on contemporary technical dictionaries and the testimony of the experts, the Court concludes that the term "record structure" is not subject to § 112, ¶ 6 because the term would have connoted sufficient structure to those of ordinary skill in the art. The Court construes the term "record structure" to mean: computer hardware and software required to receive data signals, update files, and store information.

The limitations containing the term "record structure" provide that the record structure includes memory and "control means ... for accessing a file." The parties agree that "control means" is subject to § 112 ¶ 6. The plaintiffs point to the Processing Unit 92 and Memory 98, including cells C1 through Cn in Figure 4 or Processors PR1 through PRn in Figure 1 as the structures that correspond to "control means." The plaintiffs contend that an alternative structure for control means disclosed in the patents is a microcomputer or microprocessor, such as the Central Processing Unit 251 in Figure 9, programmed to perform the disclosed functions.

The defendants agree that the term "control means" corresponds with the structures the plaintiffs have identified, but the defendants contend that the term also must include the associated wiring and software.

The first step in means-plus-function analysis is to identify the function performed by the means; here, the function of the "control means" is to receive calling number identification data, to access a file, and to store data relating to certain of said individuals callers. The Court concludes that the patent discloses that the control means correspond to the Processing Unit 92 and Memory 98, including the cells, C1 through Cn in Figure 4 and the Processors PR1 through PRn in Figure 1. *See* Column 16, lines 24-28, and 44-46 of the '707 patent and Column 18, lines 21-25 of the '707 patent. In addition, "control means" corresponds to the software that enables these structures to perform the functions of receiving and storing data and accessing files. The Court concludes that the control means also correspond to a microprocessor, such as the Central Processing Unit 251 in Figure 9, programmed to perform the disclosed functions, as such a structure can also perform the disclosed ***604** functions of the control means. *See* Column 5, lines 12-33, Column 9, lines 59 to 67, and Column 21, lines 9-20 of the '707 patent.

The core dispute between the parties in relation to the record structure limitations is over the meaning of the term "accessing." The plaintiffs argue that the term "accessing" includes anything a computer can do to a file, such as creating or opening records or storing additional information entered by callers. The defendants argue that the term "accessing" does not encompass deleting a file or creating or initiating a file because a file must exist before it can be "accessed." The defendants point to passages of the specification in which the ideas of updating a file are distinct from creating a cell in memory in the first instance. *See* Column 12, line 63-65, Column 16, lines 29-32, and Column 17, lines 29-30 of the '707 patent. Thus, they contend that the term "accessing" must mean retrieving a file that already exists.

In Claim 51 of the '309 patent, Katz recites a "record structure, including memory and control means, ... for *updating* a file." This indicates to the Court that the use of the word "accessing" in a similar limitation in another claim connotes a different meaning. Further, although Katz describes updating files and assigning cells in memory as different functions in the specification, there is nothing in the specification that indicates that the term "accessing" could not

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encompass both of those functions.

Webster's Dictionary defines the verb "access" as "to get at, gain access to." Addenda to *Webster's 3rd New International Dictionary* at 55a (1986). As a noun, the term is defined as "permission, liberty, or ability to enter, approach, communicate with, or pass to and from" or "freedom or ability to obtain or make use of." The Court concludes that the term "accessing" means in the context of the Katz patents: gaining or obtaining the ability to enter or make use of files. The Court further concludes that the term "accessing" in the context of the Katz patents does not delineate or restrict the types of functions that may be performed on the files once they are accessed, such as updating files, creating new files, or deleting files.

e. "Qualification Structure"

[28] "Qualification structure" appears in many of the Analysis Control System Claims, and the limitations in which this term appears vary from claim to claim. [FN16] Claims 104 and 117 of the '707 patent and Claim 171 of the '863 patent include the broadest limitation including the term, providing for a "qualification structure controlled by said record structure for controlling access to said system by said individual callers." The other limitations containing this term vary on how and on what basis access to the system is controlled.

FN16. The term "qualification structure" appears in Claim 51 of the '309 patent, Claims 33, 104, and 117 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent.

The plaintiffs argue that this term is not subject to means-plus-function analysis because the term "qualification structure" was well known to those of ordinary skill in the art of building interactive voice applications. The plaintiffs contend that "qualification structure" would have brought to mind a computer processor and its software programs to those of skill in the art.

The defendants argue that this term is subject to means-plus-function analysis because it is written in functional terms and has no meaning to those of ordinary skill in the art without more information than is provided in the claim language. The defendants argue that the term does not escape application of § 112, ¶ 6 because it calls to mind a computer processor and its programs, as plaintiffs contend. The defendants argue that the structure in Figure 4 that corresponds to this term is the Qualification Unit 93, the Processing Unit 92, the Memory 98, and the software required to qualify callers. *See* Column 6, ***605** line 56 to Column 7, lines 36 and Column 16, lines 19-31 of the '707 patent. The defendants contend that the only software that is disclosed in the patents is in the context of the specific formats discussed by Katz, such as game shows, lotteries, and auctions.

The Court concludes that although the term "qualification structure" does not include the term "means," it is subject to § 112, ¶ 6. "Qualification structure" is written in functional terms and the Court is not convinced that it would not have brought to mind sufficient structure to a person of ordinary skill in the art without further reference to the specification. The function performed by the "qualification structure" is controlling access to the Katz system by individual callers. The structures disclosed in the specification that perform this function are the Qualification Unit 93 and the Processor 92 in Figure 4. [FN17]

FN17. For the term "qualification structure" in Claim 33 of the '707 patent, which provides for "[a]n analysis control system according to claim 26, wherein said limit on use restricts relates to a dollar amount," the defendants claim that the corresponding structures are the Qualification Unit (93) and Look-up Table (99) or Use Rate Calculator (100) in Figure 4, as well as the software required to perform the function of testing the data from callers to specify a basis for entitlement to assess to the Katz system. *See* Column 17, lines 38-62 of the '707 patent. The Court concludes that these structures designated by the defendants correspond to the qualification structure in Claim 33 of the '707 patent.

The qualification structure limitations raise additional construction issues. In Claims 49 and 50 of the '863, the qualification structure controls access to the Katz system "based on at least two forms of distinct identification including caller customer number data and at least one other distinct identification data element consisting of personal identification data." The parties agree that a "caller customer number" is a number that is assigned to a merchant's own customer; however, the defendants

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contend that the caller customer number cannot be a credit card number because it is not assigned from a vendor to a customer. The defendants point to Column 11, lines 6-7 of the '863 patent, which describes the customer number in a mail order format as the number found on the customer's catalog. Thus, the defendants argue the customer number cannot be a credit card or charge number because such a number does not identify the caller as a customer of the merchant. In Column 11, lines 19-22 of the '863 patent, Katz states that a caller's customer number may be stored along with his credit card number and expiration date; the defendants argue that this indicates that a customer number and a credit card number are two separate items.

The defendants also argue that the second piece of identification data cannot be a personal identification number (PIN) or an expiration date from a credit card because such numbers are not unique to the individual, or "personal," without the corresponding credit card number or calling card number. The defendants point out that in Column 11, lines 1-5 and 19-22 of the '863 patent, Katz describes "other distinct identification data" in the mail order format as both a credit card number and its expiration date.

Along with the specification, the defendants point to the prosecution history of the '707 patent as support for their construction of "caller customer number data" and "other distinct identification data." In the May 8, 1995 Office Action during the prosecution of the '707 patent, the examiner rejected pending Claim 33, which provided for a "record structure with means for recording an identification card number and at least one other distinct identification data element," as unpatentable over the '554 patent to Asmuth. The examiner noted that Asmuth contained the "record structure" of Katz's claim and taught "that input 'caller data signals' may include a telephone credit card number (in the claim 'identification card number') ... and a 'distinct identification data element' consisting of 'personal identification data' (in the patent *606 a 'PIN')." Katz subsequently amended what was then Claim 33 to recite a qualification structure in a form similar to the claims at issue. *See* August 31, 1995 Amendment. In his comments to that amendment, Katz stated that he added a "qualification structure" requiring two forms of distinct identification including a caller's customer number to qualify a caller, and that the addition of the qualification structure and the fact that Asmuth stored data to define the virtual private network while his invention stored data developed by the callers rendered the Katz invention distinct.

As for the term "caller customer number data," the claim language does not support the narrow construction proposed by the defendants. That is, there is no support in the claims for the notion that this form of identification could not be a credit card or other charge number if such a number identified the caller as a customer of a particular merchant or vendor. The mention in the specification of storing the customer number as distinct from the credit card number was given as an example; similarly, the example of the customer number located on a customer's catalog was not provided as a requirement for a customer number.

The second term, "distinct identification data element consisting of personal identification data," is not subject to the narrow construction proposed by defendants either. The word "distinct" indicates that this second form of identification must be different than the first form of identification for each caller. The claim language also requires that this second piece of information contain something "personal" by way of identification, that is, data that is assigned to a person or identifies a person as an individual as opposed to a customer of a merchant or vendor. Nothing in the claim language instructs that this second piece of identification cannot be a *personal* identification number (PIN) or an expiration data from a credit card as long as the data identifies the individual. The prosecution history cited by the defendants does not require that the Court adopt the defendants' construction either; Katz did not state in the Amendment that his system would not accept a PIN as a form of personal identification.

Thus, based on the claim language, the Court construes "caller customer number data" to mean: a number assigned to a customer by a vendor or merchant or recognized by a vendor or merchant for the purpose of identification of the customer. The Court construes "other distinct identification data element consisting of personal identification data" to mean: data that identifies a caller as an individual which is distinct from customer number data.

f. "Means for Selecting"

[29] The parties agree that the term "means for selecting" is subject to means-plus-function analysis. This term appears in Claim 104 of the '707 patent, in dependant Claim 103. The function, which is set out in the claim language itself and described in Column 10, lines 34 through 43 of the '707 patent, that is performed by the "means" is selecting a specific one of a plurality of formats based on the called number. In Column 4, lines 52 through 59, the specification of

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the '707 patent discloses that the "interface 20 incorporates ... DNIS ... capability (call data analyzer 20a)." As explained in line 62 of the same column through line 2 of Column 5, "DNIS" is a function of the communication facility which provides data indicating the called number and may be used with the interface 20 and call data analyzer 20a.

The defendants contend that the Automatic Call Distributor AC1, the Interface 20, and the Switch 21 correspond to the "means" in "means for selecting." However, the specification at Column 6, lines 37 through 48 indicates that the ACD merely receives the call signal from the caller and "associates" the called number through the interface and the switch to the specific processor that contains the particular format associated with called number. Similarly, in Column 10, lines 31-43, the specification ***607** discloses that the communication facility couples the caller at the remote terminal to the correct processor to run the format selected by the called number through the ACD, the interface, and the switch. These passages do not specify which of these structures is performing the specific function of *selecting* the format based on the called number, as opposed to connecting the caller to the correct processor once the format has been selected.

The portion of the specification cited above from Columns 4 and 5 more clearly identifies that the interface and the CDA are the structures which perform the disclosed function. Thus, the Court concludes that the disclosed structure that corresponds to the "means" in "means for selection" is the Interface 20 and the Call Data Analyzer 20a in Figure 1. The ACD and the switch do not correspond to the means.

g. "Switching Structure"

[30] The term "switching structure" appears in Claims 49 and 50 of the '863 patent, and in context reads "switching structure coupled to said interface structure for switching certain select ones of said individual callers at said remote terminals to any one of a plurality of live operators wherein said live operators can enter at least a portion of said caller data relating to said select ones of said individual callers through interface terminals, which is stored in said record structure."

The plaintiffs contend that this term is not subject to means-plus- function analysis because the term "switch" is well known to those experienced in computer telephony and it brings to mind structure to those of skill in the art. The plaintiffs argue that switching structure should be defined as "hardware with associated software used to route calls." (Pls.' Appendix at 164).

The defendants contend that the term "switching structure" is subject to analysis under § 112, ¶ 6 because the term lacks a sufficiently definite structure such that one of skill in the art would not know what structure to build without more information than is provided in the claim. The defendants argue that in the passages that discuss the switching structure, including Column 5, lines 51-55; Column 7, lines 13-17; Column 10, lines 45-52; and Column 11, lines 8-12 of the '863 patent, Katz did not disclose structure to perform the entire function performed by the means, which is switching callers to a live operator, where the live operator enters caller data for storage in the record structure.

During the *Markman* hearing, all of the experts referred to "switches" in their discussion of computer telephony at the time of the Katz patents. Similarly, the term "switch" was often used in contemporary references and prior art referred to by the parties at the hearing. The Court concludes that, based on these examples of the state of the art and the testimony of the experts, the term "switching structure" does not implicate § 112, ¶ 6. The Court concludes that the term would have connoted a specific set of structures to those of ordinary skill in the art. Thus, based on the claim language and the specification, the Court construes the term "switching structure" to mean: a device including hardware and associated software that can switch or route telephone calls or signals from one location or connection to another.

h. "Record Testing Structure"

[31] The term "record testing structure" appears in Claim 192 of the '707 patent. The limitation in full provides for a "record testing structure connected to receive and test said caller data signals including said calling number identification data and said caller personal identification data against previously stored calling number identification and caller personal identification data."

The plaintiffs argue that this term is not subject to means-plus-function analysis because it would have called to mind sufficient structure to those of ordinary skill in the art. The plaintiffs propose that the Court construe "record testing structure" to mean "a hardware device, with associated***608** software, used to store information and implement tests based on that information." (Pls.' App. at 155).

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The defendants argue that "record testing structure" is subject to § 112, ¶ 6. The structures the defendants contend corresponds to the function performed by the record testing structure are the Processing Unit 96, the Qualification Unit 93, the Buffer Storage 97, either the Look-up Table 99 or the Use Rate Calculator 100, and the logic within the qualification unit to receive information regarding the calling number from the interface. Further, the defendants argue that the structure corresponding to "record testing structure" cannot be any computer with any type of memory; if this were the case, the defendants argue, § 112, ¶ 6 would have no meaning. The defendants contend that the processing unit must be programmed to receive decoded personal identification data from the callers and to test it against stored data for the callers.

The Court concludes that "record testing structure" implicates § 112, ¶ 6 because "record testing" is clearly a functional term and it does not connote any structure for performing the function of receiving and testing said caller data signals including said calling number identification data and said caller personal identification data against previously stored calling number identification and caller personal identification data. The Court concludes that the structures disclosed in the specification that correspond to "record testing structure" are the Processing Unit 96, the Qualification Unit 93, and the Look-Up Table 99 in Figure 4. *See* Column 10, lines 1 through 25 of the '707 patent. Contrary to the defendants' contentions, the described functions of the Use Rate Calculator 100 and the Buffer Storage 97 in Column 10, lines 1 through 25 of the '707 patent are not required to perform the function of receiving and testing signals against stored data called out in the claim. Thus, these structures do not correspond to record testing structure.

3. "Processing"

[32] The next term the parties presented to the Court for construction from the Analysis Control System patents is "processing." In Claims 104 and 117 of the '707 patent, the term appears in context as "means for processing at least certain of said data developed by said terminals and said calling number identification data relating to certain select ones of said individual callers." In Claim 192 of the '707 patent, the terms appears in context as "analysis structure for receiving and processing said caller data signals under control of said record testing structure." The final analysis control system claim at issue in which "processing" appears reads "means for processing at least certain of said data developed by said remote terminals relating to certain select ones of said individual callers." Claim 171 of the '863 patent.

The parties agree and the Court concludes that the phrase "means for processing" is a means-plus-function limitation subject to § 112, ¶ 6. The structures corresponding to the "means" in "means for processing" include the Processing Unit 92 in Figure 4, the Central Processing Unit 251 in Figure 9, or the Processors PR1 through PRn in Figure 1.

The defendants argue that the term "analysis structure" in "analysis structure for ... processing" is also subject to means-plus-function analysis. To support their position, the defendants contend that in the '739 patent, which shares the same specification as the '707, '863, and the '309 patents, Katz used the term "analysis means" in limitations similar to the limitations which contain "analysis structure." The plaintiffs contend that "analysis structure" had meaning to those in the art and connoted computer hardware and software used to analyze data, such as a processor. (Pls' App at 160-61). The Court concludes that the term analysis structure is written in functional language and does not connote sufficient structure to avoid the application ***609** of § 112, ¶ 6, despite the presumption to the contrary. The function of the analysis structure in the terms of the claim language is "receiving and processing said caller data signals under control of said record testing structure." The structures that correspond to "analysis structure" are the same as those that correspond to the "means" in "means for processing," i.e., the Processing Unit 92 in Figure 4, the Central Processing Unit 251 in Figure 9, or the Processors PR1 through PRn in Figure 1.

The core dispute between the plaintiffs and defendants is whether "processing," as used in "means for processing" or otherwise in the patents, requires a specific type of processing. The defendants contend, in the context of their means-plus-function arguments, that the structures that correspond to the "means" in "means for processing" also include the software that performs the function of processing, and because the only type of processing disclosed in the specification is statistical analysis to isolate a subset of callers in the context of the specific formats disclosed, the computer must be programmed with software that performs this particular kind of processing. Specifically, the defendants argue that all of the disclosed formats in the specification, including a health poll format, mail order format, instant lottery format, auction sale

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format, television game show formats, and television poll format, require the use of statistical analysis to isolate a subset; thus, they argue, "processing" and "statistical analysis" are synonymous. The defendants also argue that if the term "processing" is given a broad, unlimited meaning, it would render other limitations that call out specific functions of a computer surplusage, such as "accessing" a file, "storing" data, and "testing" data.

The plaintiffs argue that the defendants' proposed construction of "processing" has no support in the claim language, and that the defendants are attempting to define the function of "processing" by importing structural limitations from the specifications. The plaintiffs argue that the term should be given its ordinary meaning, which is "performing some operation or sequence of operations on data and/or telephone calls." (Pls.' Appendix at 7).

The term "processing," even as part of the phrase "means for processing," is not subject to means-plus-function analysis, so an immediate resort to the specification for meaning is not appropriate unless there is some "hook" in the claim language on which limitations from the specification may be hung. *See Renishaw*, 158 F.3d at 1252. Thus, if the term "processing" in the context of the claim language had a common, ordinary meaning to those of ordinary skill in the art, that meaning is the proper construction of the term, even if it is broad. *See Johnson*, 175 F.3d 985, 989.

Contemporary technical dictionaries indicate to the Court that "processing" had a broad meaning to those of skill in the art for some time. In the context of these claims it is clearly implied that the processing is being performed on data. The *Standard Dictionary of Computers and Information Processing* by Martin H. Weik (1969) defines the verb "process" as follows: "In data processing, to handle, manipulate, or perform some operation or sequence of operations on data in accordance with a specified or implied algorithm, usually as a series of discrete steps, including operations such as compute, assemble, compile, interpret, generate, translate, store, retrieve, transfer, select, extract, shift, search, sort, merge, transliterate, read, write, print, erase, and punch. The processing usually results in a solution to a problem." (Ex. 458). In the *Computer Dictionary*, by Charles J. Sippl (1966), the term "process" is defined as a "generic term that may include compute, assemble, compile, interpret, generate, etc." (Ex. 498). In the *Dictionary of Computing and New Information Technology*, by A.J. Meadows et al. (1984), the term "data processing" is defined as including "all clerical, arithmetical and logical ***610** operations on data. Data processing in the context of information technology always implies the use of a computer for these operations." (Ex. 483).

The claim language also shows that the term "processing" does not by itself indicate statistical analysis to isolate a subset of callers. Many claims, dependent and independent, in the '707, '863, and '309 patents specifically call out processing to isolate a subset of callers. For example, Claim 169 of the '707 patent specifically calls out processing to isolate a subset of callers. Claim 174 of the '863 provides for "subsequent" processing that isolates a subset of callers; however, Claim 171, upon which Claim 174 depends, does not require such a parameter on the initial processing. Similarly, Claim 181 of the '863 provides for "processing ... responsive to said approval signals." Claim 185 of the '863 patent, which is dependant on Clam 181, specifically provides for processing to isolate a subset callers. The fact that "processing" is called out in some claims, and then specifically "processing to isolate a subset of callers" is called out in other claims, some of which are dependant on the claims that call out "processing" generally, indicates that the independent claims which contain the term "processing" do not necessarily require that the processing perform statistical analysis to isolate a subset of callers or data. *See Rodime PLC v. Seagate Technology, Inc.*, 174 F.3d 1294, 1306 (Fed.Cir.1999). If the term "processing" were given the limited scope explicitly called out in the dependent claims, those claims would be rendered superfluous, a result that should be avoided if the claim language will allow under the doctrine of claim differentiation. *See Laitram Corp. v. Rexnord, Inc.*, 939 F.2d 1533, 1538 (Fed.Cir.1991). [FN18]

FN18. The defendants contend that under *Laitram*, claim differentiation does not apply to means-plus-function limitations; however, the term "processing" is the functional language of the claim and is not subject to means-plus-function analysis.

There is nothing in the specifications that requires the Court to alter the broad meaning of "processing" conveyed in the claims, even though the subject of statistical analysis to isolate a subset of callers is repeatedly discussed. The name of the patents under consideration is "Telephonic- Interface Statistical Analysis System." At several points in the

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specification, Katz describes his invention generally or one of the formats generally as performing statistical analysis to isolate a subset of callers. *See* Column 1, line 58-67 of the '707 patent (providing that "[i]n general, the present invention comprises a telephonic-interface system and related process ... in a variety of different interface formats or programs, as to ... statistically analyze acquired data, as in combination and is association with external data (time independent), and accordingly to isolate a subset of the callers with variable identification"); Column 2, line 22-26 of the '707 patent (providing that "in accordance with various formats, acquired data is processed in statistical relationship, or in relation to applied external data"); Column 5, lines 53-55 of the '707 patent (providing that "[i]n general, the processing evolves a subset (at least one caller) the members of which may be verified or confirmed"); Column 21, lines 33-38 (providing that "[i]n view of the above explanation of exemplary systems, it will be appreciated that other embodiments of the present invention may be employed in many applications to accumulate statistical data, process such data, and define subsets of callers of concern").

It is no surprise that Katz discussed statistical analysis to isolate a subset of callers in the specifications to the '707, '863, and '309 patents because he specifically called out this function in some, but not all, of the claims in those patents. Conversely, there is no mention in the specifications to the '285 and '150 patents of "statistical analysis" or "isolating a subset of callers" because none of the claims in those patents specifically call out such processing, even though the term "processing" ***611** appears in the claims of those patents. While the specifications of the '707, '863, and '309 patents call out several embodiments of the Katz invention in which processing is performed to isolate a subset of callers through statistical analysis, not all of the claims that contain the broad term "processing" require this limitation. Whether, as defendants argue, Katz's claims are broader than his disclosure in the specifications of his patents, is a question for another day and does not alter the construction of "processing," a term that clearly had a broad and common meaning to those of ordinary skill in the art.

The portions of the prosecution history highlighted by the defendants do not conflict with the common understanding of "processing." During the prosecution of the '968 patent, from which the patents-in-suit descended, Katz distinguished his invention from a collection of prior art in part on the basis that his invention variously incorporated "(1) personal participant selectivity, (2) participant record development and (3) analytical inter- related data processing with respect to developed records." (Ex. 33, March 2, 1988 Amendment at 14). The defendants argue that this statement by Katz indicates that all of his claims, including pending Claim 37 which did not explicitly call out "statistical analysis to isolate a subset," incorporate statistical analysis or "inter-related processing." However, pending Claim 38, which was dependent on Claim 37, added the specific limitation of "processing said statistical data as to isolate a subset of said individual callers." Katz's assertions during the prosecution of the '968 patent that his invention *variously* incorporated three elements does not require, and this Court will not, import the limitation of "analytical inter-related data processing" or "statistical analysis to isolate a subset" into the definition of "processing" in claims of the '968 patent, or of any of the patents at issue in the *Markman* hearing.

During the prosecution of the '923 patent, which has the same specification as the '707, '863, and '309 patents, Katz attempted to distinguish his invention from a patent to Riskin by stating that the Riskin patent did not "suggest any interrelated processing between callers, nor are processing files formed other than merely to accommodate billing." (Ex. 38). In an Appeal Brief dated September 11, 1992 during the same prosecution, Katz described his invention as systems that "statistically acquire data, as in combination with and in association with external data (time independent), and accordingly isolate a subset of the callers with verifiable identification." (Ex. 38). Similarly, in the Information Disclosure Statement dated January 31, 1996 at 13 during the prosecution of the '185 patent, Katz informed the PTO that "[i]n various applications, Applicant's inventive systems have utilized an operation of processing data to isolate a subset of callers. In a refined form, the operation involves processing data from callers in combination to isolate a select subset of the callers by 'interrelated' processing." (Ex. 56). These statements by Katz indicated that his patents suggest or include interrelated processing or statistical analysis to isolate a subset of callers, which is clear by the claims which explicitly call out this function. However, none of these statements by Katz indicates that any particular claim includes this type of processing or that all processing suggested in his patent is of this type.

Based on the foregoing, the Court construes the term "processing" to mean: manipulation of data which performs some operation or sequence of operations on the data.

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4. "Format"

[33] The next term presented to the Court for construction is "format." This term appears in many of the claims at issue in the *Markman* hearing. For example, Claim 104 of the '707 patent provides for "[a] system according to claim ***612** 103, wherein said called number identifies a specific one of a plurality of operating formats for interface." Claim 192 of the '707 patent provides for "[a]n analysis control system according to claim 191, wherein said select called number (DNIS) identifies a select format from a plurality of distinct operating formats."

The plaintiffs contend that the term "format" as used in the patents had a common meaning to those of ordinary skill in the art, and they ask the Court to define "format" as "a computer program, including instructions and/or pre- recorded messages, for providing a service to callers." (Pls.' Appendix at 7).

The defendants argue that although the term "format" only explicitly appears in some of the claims, the concept of "format" is implicit in all of the claims and corresponds to the "analysis control system" that is called out in the claims under consideration. Arguing that the term is imprecise and ambiguous without reference to the specifications, the defendants contend that "format" is defined by Katz in the specification as analysis that isolates a subset of callers and should be limited to include only the seven formats disclosed in the specifications, including mail order, auction, health poll, television game show, television game show requiring participation numbers, lottery, and television poll formats. Alternatively, the defendants argue that if the Court does not limit "format" to the seven disclosed embodiments, it should define "format" by common threads present in all the formats disclosed; for example, the defendants contend that a format must include a data acquisition phase in which callers enter or are assigned data for processing, and a processing phase in which that data for multiple callers is statistically analyzed with like data for other callers or with common external data to isolate a subset of callers participating in the format.

Construction begins with the claim language, and the language here is instructive. Considering Claim 192 of the '707 patent, which is quoted above, it is clear that "analysis control system" and "format" are not the same concept, as the claim includes both terms and indicates that the format is only a part of the analysis control system.

The language of other claims which were not designated for the *Markman* hearing supports a construction of format that does not require statistical analysis and is not limited to the seven disclosed embodiments of the specifications. In some claims, Katz specifically limited the format in a claim to a particular type of format. For example, Claim 42 of the '707 provides for a "promotional format," Claim 45 of the'863 patent provides for an "order format," Claim 46 of the '863 provides for a "television initiated mail order operation," and Claim 56 of the'863 provides for a "merchandising format." The fact that these particular formats are called out in some of the claims indicates that the term "format" alone is not limited to any particular format or set of formats.

The specifications of the patents do not indicate that "format" must include statistical analysis or be limited to the disclosed embodiments. Although the Background and Summary of the Invention in the specifications to the '707, '863, and '309 patents describes the invention as generally performing certain functions, including statistically analyzing data, it does not explicitly require that the "format" include statistical analysis or that the "format" is performing the statistical analysis. *See* Column 1, lines 43- 47, 57-67 of the '707 patent; Column 2, lines 4-14, 22-26 of the '707 patent. In addition, the language of the Background and Summary of the Invention is exemplary; it provides what the invention is *generally* or what it *may* include or perform. *See* Column 1, lines 43 through 67 of the '707 patent. Similarly, in describing the seven disclosed embodiments of his invention, Katz repeatedly stated that the examples were illustrative or exemplary. *See, e.g.,* Column 9, lines 48 through 51; Column ***613** 11, lines 66 through 67; Column 12, lines 1 through 19 of the '707 patent.

Figure 3 of the '707, '863, and '309 patents is a flow diagram for one operating format of the Katz system. *See* Column 2, lines 44-45 of the '707 patent. The diagram illustrates a series of commands or instructions for the computer and the sequencing of those commands, including the content and sequence of voice prompts and the operations on data to be stored in or retrieved from memory. There is no indication in the figure of statistical analysis or that the format is limited to the disclosed embodiments. To limit the term "format" in these patents to the disclosed embodiments would violate the ruling of *Comark Communications, Inc. v. Harris Corporation,* 156 F.3d 1182, 1187 (Fed.Cir.1998) and similar cases.

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The prosecution history cited by the defendants does not support their proposed construction of "format." During the prosecution of the '023 patent, the examiner rejected certain of Katz's claims as anticipated by a patent to Riskin because the Riskin patent described various "formats," including stock quotation, movie directory, and product information services. (Ex. 48). Similarly, during the prosecution of the '120 patent, the examiner rejected certain of Katz's claims as being unpatentable over a group of references because the claims contained "game" or "operating process" formats that were selected through the use of the dialed number. These statements indicate that the examiner did not consider the Katz formats to be limited to the seven embodiments disclosed in the specifications because the examiner rejected some of Katz's claims as unpatentable over patents which contained "formats" other than the seven described by Katz. The defendants pointed to no statements by Katz during the prosecution of the patents in which he disclaimed coverage of any formats other than the formats discussed in the specifications.

Based on the foregoing, the Court construes the term "format" to mean: a computer program that sets forth the content and sequence of steps to gather information from and convey information to callers through pre-recorded voice prompts and messages.

5. "Multiple Formats" or "Plurality of Formats"

[34] The parties also disagree over the proper construction of the terms "plurality of formats" and "multiple format." [FN19] The plaintiffs argue that the terms "plurality" and "multiple" clearly had the common and plain meaning of "more than one" to one of ordinary skill in the art. The defendants do not contest that these terms mean "more than one," but rather they argue that because it is impossible to know whether a system is running on one format or more than one format, "multiple" or a "plurality of" formats must have three characteristics. First, each format must be a separate computer program and not just different questions or branching in the same format. Second, each format must have distinctly different subject matter and functionality. Third, each format must be reached by a different and unique called number.

FN19. These terms appear in the Conditional Format Claims at issue in the '150 and '285 patents and the Participation Number claims at issue in the '707 and '863 patents.

The plaintiffs agree that subroutines or branching within a format do not constitute multiple formats. The specification of the '707 patent confirms this. *See* Column 18, line 37 (noting in the context of the television game show format that "the basic format can remain the same, only the questions change by time zone"). The plaintiffs also agree that one phone number cannot be used to reach different formats. The specifications support this understanding of "multiple formats" or "plurality of formats." *See* Column 12, lines 5-6 (noting that one of the common structural elements of the Katz invention is "utilizing the called number to select a ***614** specific operating format"). However, the patents do not support the defendants' contention that each format of a plurality of formats or multiple formats must be assigned a unique called number.

The patents also do not support the defendants' contention that each format in a plurality of formats or in multiple formats must be different in the function it performs or in subject matter. In the '150 patent specification, Katz states that "[e]xemplary selected formats of the processor might include: public polls, lotteries, auctions, promotions, sales operations and games;" the use of plural to describe the formats indicates that the processor could run more than one of any type of format. Column 2, line 65 to Column 3, line 1 of the '150. Thus, if a processor is running a series of formats, even if all are lotteries or all are mail order formats, this would constitute a "plurality of formats" or "multiple formats."

The prosecution history cited by the defendants does not dictate that the Court should alter the construction of "multiple formats" or "plurality of formats" that is clear from the claim language and specifications. In an Amendment dated January 11, 1990 during the prosecution of the '506 application, Katz amended one of his claims to recite "a plurality of distinctly different operating process formats." (Ex. 36). However, the examiner subsequently rejected this claim as amended, and this particular language does not appear in any of the claims at issue. During the prosecution of the '150 patent, Katz noted in an Amendment dated October 5, 1989 that the patent to Riskin "contains no suggestion of a multiple format processor nor structure for conditioning accepted calls." [FN20] (Ex. 35). The Court concludes that Katz was not limiting the term "multiple format" to require formats with different subject matter or functionality in this statement to the PTO.

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FN20. Katz made a similar statement in an Amendment dated June 30, 1992 during the prosecution of the '285 patent. (Ex. 50).

Based on the foregoing, the Court construes the terms "plurality of formats" and "multiple formats" to mean: more than one format. The terms do not include the subroutines or branching within a single format.

6. "Remote Terminals"

[35] The parties dispute the meaning of the term "remote terminals," which appears in claims throughout the body of patents to Katz. The parties agree that the term refers to traditional telephones, but the plaintiffs contend that the term may comprise other devices as well, such as wireless phones or a computer that can access the telephone network.

The plaintiffs contend that a person of ordinary skill in the art reading the Katz patents would understand that "remote terminals" could refer to devices other than traditional telephones. The defendants argue that there is no support in the specifications for any device other than traditional telephones.

The claim language in the patents does not support the defendants limited definition. Claim 96 of the '707 patent is exemplary of many of the claims that contain the term "remote terminals." Claim 96 provides for "[a]n analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphanumeric buttons for providing data." The use of the words "*may* comprise" indicates that remote terminals includes, but is not limited to, traditional telephones.

The specification does not limit "remote terminals" to conventional telephones only. In Column 3, line 55 through Column 4, line 18 of the '707 patent, Katz describes ***615** the remote terminal illustrated in Figure 1. Although Katz describes what would be considered a traditional or conventional telephone, the specification is clear that the remote terminal in Figure 1 is the illustrative embodiment and that the description of it is exemplary.

The prosecution history cited by the defendants does not restrict the definition of "remote terminals." In the prosecution history of the '968 patent, in an Amendment dated March 2, 1988, Katz attempted to distinguish his patent from other patents containing, among other devices, "a special form of terminal apparatus at a data source" by noting that "[c]ontrary to the operations of the systems described in the above references, applicant's system interfaces with a *conventional telephone instrument.*" (Ex. 33). Katz went on further to explain regarding "special-purpose telephone instruments" that "[c]learly, such telephones could be employed in cooperation with applicant's system; however, a very significant feature of applicant's system is its ability to function cooperatively with a conventional telephone instrument. Accordingly, specific forms of transaction telephone instruments or data phones are not deemed to be particularly applicable to the claims as set forth herein...." Contrary to the defendants' contention, the Court concludes that this statement by Katz indicates that his system could accommodate conventional telephones, as well as other devices, not that it was limited to use with conventional telephones.

Thus, the Court concludes that there is nothing in the claim language, specifications, or prosecution history that indicates that "remote terminals" can only include conventional or traditional telephones and not wireless phones or computers connected to the telephone network. Based on the foregoing, the Court construes "remote terminals" to mean: a device or instrument for connecting callers to the telephone network for voice and digital communication, including, but not limited to, conventional telephones.

7. "DNIS" and "called number identification data"

[36] The next terms the Court must construe are "DNIS" and "called number identification data." These terms appear in many of the Analysis Control System claims, including Claim 104 of the '707 patent which reads "a system according to claim 96 for use with a communication facility having a capability (DNIS) to provide called number identification data to identify a called number from a plurality of different numbers for calling," [FN21] Claim 192 of the '707 patent which reads "an analysis control system according to claim 183, wherein said communication facility automatically provides called number identification data (DNIS) to identify a select called number from a plurality of called numbers," and Claim 65 of the '863 patent which reads "an interface structure ... including means to automatically receive call number identification

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signals (DNIS) to identify a select format from a plurality of formats." [FN22]

FN21. This language is found in Claim 103 of the '707 patent, upon which Claim 104 depends.

FN22. The terms "DNIS" and "called number identification data" appear in claims other than the Analysis Control System claims; the parties agree and the Court concludes that the terms have a uniform meaning across all of the claims at issue.

The parties agree that the terms "DNIS" and "called number identification data" have the same meaning and are used interchangeably in the patents. The plaintiffs contend that the terms mean "a signal representative of the number called."

The defendants argue that DNIS or called number identification data must represent the full dialed number, which is seven or ten digits. The defendants also contend that DNIS or called number identification data cannot be internal routing ***616** numbers or vector directory numbers; because the claims indicate that the communication facility provides DNIS or called number identification data *to* the interface and the interface *receives* DNIS or called number identification data *from* the communication facility, the defendants argue that DNIS or called number identification data cannot be any signal sent internally in the communication facility.

The Court concludes that the terms "DNIS," "called number identification data," and like terms have the same meaning and are used interchangeably in the patents. The term "DNIS" is an acronym for "dialed number identification service." Both "dialed number identification service" and "caller number identification data" contain the word "identification," and the plain import of these phrases is a signal or data that identifies the number that has been called. Thus, the language of the claims does not support the defendants' argument that "DNIS" or "called number identification data" must be the full seven or ten digit dialed number. The claim language does not support the defendants' argument that "DNIS" or "called number identification data" cannot include internal routing numbers within the telephone network; indeed, such numbers are neither mentioned in nor relevant to the Court's construction of the claims at all.

The passages of the specifications to which the defendants point do not support the limited construction proposed by the defendants either. In Column 12, lines 2 through 6 of the '707 patent, Katz describes one of the structural elements that have reoccurring significance in his inventions as "utilizing the called number to select a specific operating format." The defendants emphasize that Katz lists a ten or seven digit number as an example of the called number in the specifications; in Column 6, lines 41-45 of the '707 patent, Katz explains that "[r]eceiving the call signal, the automatic call distributor AC1 associates the called number ((213) 627-3333, rendered available using standard telephone DNIS techniques) through the interface 20 and the switch 21 to attain connection with the specific processor...." However, the mere reference to "called number" does not restrict "called number identification data" to a certain number of digits, nor is there reason to restrict the terms "DNIS" and "called number identification data" to the examples provided by Katz in the specifications.

Further, in Column 4, lines 62 through 64 of the '707 patent, Katz stated that "[g]enerally, DNIS capability is a function of the communication facility C (composite telephone system) to provide called terminal digital data indicating the called number." "Data indicating the called number" undermines the defendants contention that the data must be the full dialed number. Similarly, in Column 10, lines 39 through 42 of the '707 patent, Katz stated that "[n]ote that the communication facility C provides the dialed number ("(213) 627-4444") to the processing system P1 through well known telephonic equipment DNIS." These passages confirm that DNIS or called number identification data must only be a signal that identifies the called number and need not be only the seven or ten digit number.

The prosecution history cited by the defendants does not alter the meaning of the terms conveyed by the claim language and specifications. The first set of statements by Katz in the prosecution history, the defendants argue, indicates that DNIS or called number identification data must be the full dialed number. In an Information Disclosure Statement dated September 20, 1994 submitted during the prosecution of the '285 patent, Katz attempted to distinguish his claims from a group of patents and other references. (Ex. 50). Katz described the '012 patent to Matthews et al. as a "system identified as Direct Inward Dialing or 'DID,' which involves the capability of utilizing the last three or four digits of a

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called number for routing to a desired recipient's telephone" and distinguished ***617** the system as "quite different from the combinations set forth in the claims in that, neither DNIS signals were utilized nor were formats selected. Additionally the system was void of either qualification or operator control...." [FN23]

FN23. Katz made an almost identical statement regarding the Matthews patent to the PTO in the prosecution of the '734 patent. (Ex. 61).

Similarly, in a Supplemental Amendment dated March 14, 1995 during the prosecution of the '734 application, Katz also distinguished the '906 patent to Matthews on the basis that the Matthews system "utilizes so called 'DID' signals for accessing an individual program.... However, again, the structure and operation is distinct from Applicant's techniques utilizing DNIS for format selection and further involving testing." (Ex. 61).

It is unclear from these two statements however, whether Katz was basing his distinction on the difference between the number of digits or content of a DID signal versus a DNIS or caller number identification data signal, or if he was basing his distinction on the different *functions* that those signals performed. What is clear is that Katz did not explicitly state that DNIS or called number identification must include all of the digits of the number dialed.

The second set of statements by Katz in the prosecution history, the defendants argue, indicate that DNIS or called number identification data cannot be internal routing numbers in the telephone network. In the September 20, 1994 Information Disclosure Statement, Katz described the '682 patent to Vij et al. as "another utilization of 'DID' operation to route calls. Again, the operation is quite distinct from DNIS operation and is further distinguished from the claims herein on the basis of testing, computer interface and so on." [FN24] (Ex. 50). In the same Information Disclosure Statement, Katz described the '500 patent to Binkerd et al. as "another alternative for routing calls utilizing inputs by a caller. Again the system is quite distinct from the utilization of DNIS capability." (Ex. 50). During the prosecution history of the '075 patent in the Preliminary Amendment dated July 17, 1990, Katz stated that "[r]ecognizing that the Riskin patent discloses the utilization of ANI and DNIS signals to accomplish telephone routing, it is respectfully submitted that applicant's system involves entirely different philosophical considerations and structure. The provision of an interface system utilizing these signals, not only to select an operating format but further to accomplish associative data, is submitted to involve a patentable distinction." (Ex. 40). In an Amendment dated August 31, 1995 during the prosecution of the '707 patent, Katz attempted to distinguish the '336 patent to DeBruyn for an international lottery system on the basis that the system indicated direction or routing to different processors for individual language operation in response to different dialed numbers, but "no suggestion of DNIS appears nor is the system otherwise pertinent." (Ex. 51).

FN24. Katz made an almost identical statement regarding the Vij patent to the PTO in the prosecution of the '734 patent. (Ex. 61).

These statements indicate that Katz distinguished his inventions from other patents on the basis of the comparative functions of the systems; the systems in the other patents use signals to route telephone calls, not select a format from a group of formats or to store data associated with those signals. However, Katz never informed the PTO that the same numbers that other systems used to route calls could not be used to identify the called number and select a format. In short, it is not clear from Katz's statements, contrary to the defendants' contention, that "internal routing numbers," to the extent they can identify the called number, could not be included in the meaning of called number identification data or DNIS, as used in the Katz patents.

***618** Based on the foregoing, the Court concludes that the terms "DNIS" and "called number identification data" are synonymous and mean: a signal or data that identifies the number called.

8. "ANI" and "Calling Number Identification Data"

[37] "ANI" and "calling number identification data" are the next terms presented to the Court for construction. In general, the term "calling number identification data" appears in the claims and the term "ANI" is used in the specifications. The parties agree that "ANI" and "calling number identification data" have the same meaning.

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In the Analysis Control System Claims, the term "calling number identification data" appears in context as "receiving said calling number identification data." *See* Claims 33, 104, 117, and 192 of the '707 patent and Claim 171 of the '863 patent. In the Conditional Format claims, the terms appear in context as "call data signals as to indicate ... calling numbers" or "calling numbers as additional call data signals." *See* Claim 15 of the '150 patent and Claims 17 and 24 of the '285 patent. In the Products Carrying Participation Numbers Claims, the terms appear in context as "call data signals indicative of calling number identification data." *See* Claim 44 of the ' 707 patent and Claim 79 of the '863 patent. These terms appear throughout the Katz patents. The parties agree and the Court concludes that the terms have a consistent meaning across the claims at issue.

The arguments of the parties regarding the proper construction of these terms mostly mirror their arguments regarding "DNIS" and "called number identification data." The plaintiffs argue that these terms mean a signal provided by the telephone network that indicates all or part of the calling number. (Pls.' Appendix at 31, 69). The defendants argue that "ANI" and "calling number identification data" must refer to the entire calling number, do not include routing or billing signals used within the telephone network, and must identify the geographic location of the caller such that wireless phones are excluded. The arguments of the defendants will be addressed in turn.

There is no indication in the claim language that "ANI" or "calling number identification data" must be the full calling number; indeed many of the claims call out a signal that *indicates* the calling number. The specifications do not support the defendants' contention either. In Column 4, lines 62 through 67 of the '707 patent, Katz notes that "ANI capability is a similar function whereby the digital data indicates the calling number with calling terminal digital signals." The defendants contend that because Katz used ten digit phone numbers in his examples in the specifications, the terms "ANI" and "calling number identification data" must include the full seven or ten digit number. In Column 6, lines 62 through 65 of the '707 patent, Katz describes two ways in which the calling number could be transmitted to the Katz system; he notes that "the caller would push the buttons in sequence to indicate his telephone number, e.g. '(213) 627-2222.' Alternatively, the interface 20 can accept the calling number ((213) 627-2222) according to its provision by standard ANI equipment of the communication facility C." In Column 7, lines 29 through 30 of the '707 patent, Katz notes that "the first portion, section 53, contains a form of identification data, i.e., the caller's telephone number, i.e. '(213) 627-2222."

The first passage of the specifications cited by the defendants is provided as an example of a calling number. It is clear that the number from which a caller is calling would be a full seven or ten digit number; however, the specification is silent about what the *signal* that conveys this number, the ANI or the calling number identification data, would include. The second passage of the specifications cited by the defendants describes an example of ***619** data that is stored in a cell as represented in Figure 2, not "ANI" or "calling number identification data." Neither of these passages indicates that "ANI" or "calling number identification data" must include any particular number of digits.

As for the defendants' second argument, the claim language does not support a construction of "ANI" or "calling number identification data" that excludes routing signals or billing signals that are used within the telephone network. This argument is essentially the same as the defendants' argument that "communication facility" means that the Katz system must operate outside of the telephone network, which the Court addressed above and will not repeat here. In short, neither the claim language nor specifications mention routing or billing signals as either included or excluded in the definition of "ANI" or "calling number identification data." Determining whether routing or billing signals are signals which indicate the calling number is not a matter of claim construction, and as such, is not properly before the Court.

Further, the prosecution history cited by the defendants neither confirms their proposed construction of "ANI" or "calling number identification data" nor conflicts with the plain meaning of the terms "ANI" and "calling number identification data" conveyed by the claim language and specifications. In an Amendment dated April 15, 1996 in the prosecution of the '751 patent, Katz attempted to distinguish the '020 patent to Fodale to support his amendment. Katz described the Fodale patent as providing a system which blocks delinquent telephone terminals from making toll calls by comparing routing and billing information provided by the local telephone office against a list of delinquent terminal numbers. Katz notes that in one arrangement in the Fodale patent, ANI provides the calling or billed number. Katz stated that "[n]o reference to ANI can be located in providing the

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caller number, which presumably is otherwise available to the local toll network." (Ex. 67). The defendants contend that Katz was referring to "his" version of ANI in this last statement and distinguishing signals that are sent outside the telephone network from the billing signals or routing signals that are internal to the telephone network. The defendants' interpretation of this statement by Katz is inconsistent with his statement that Fodale uses ANI to provide the calling or billed number in one arrangement. While the meaning of Katz's statements in this Amendment is not completely clear, the Court concludes that these statements clearly do not convey the message that the defendants would attribute to them, that Katz was disclaiming coverage of routing and billing signals.

As for the defendants' final argument, there is no requirement in the claim language that "ANI" and "calling number identification data" must identify the geographic location of callers. The defendants argue that the "ANI" and "calling number identification data" must disclose the geographic location of the caller because the formats disclosed in the specifications use ANI to screen callers based on their geographic area. In his description of a television game show format in Column 18, lines 37 through 44, lines 56 through 62 of the '707 patent, Katz proposes that different questions be used for different geographic locations to accommodate the different time zones and that "area code numbers afford an effective geographic classification of callers." In the context of the discussion of a television poll format in Column 20, line 16 through 22 of the '707, Katz proposes that callers may be screened by geographic area according to their telephone number which is provided by ANI equipment. The defendants contend that because Katz uses the geographic location of the callers taken from the calling number in these formats, the Mobile Identification Number or MIN supplied by wireless phones cannot constitute "calling number identification data" or "ANI" because MIN does not supply an ***620** accurate indication of the callers geographic location. However, in the discussion of an instant lottery format in Column 12, lines 46 through 47 of the '707 patent, Katz proposes the use of a caller's telephone number and date of birth to qualify a caller based on his age; in this example, the calling number is not used to qualify a caller based on his geographic location. Similarly, Claims 165 and 175 of the '707 patent call out the use of calling numbers for purposes other than determining geographic limitations. To adopt the defendants' construction of the terms at issue to always require the identification of the geographic location of the caller would not only improperly limit the claims by the examples disclosed in the specifications, but also would limit the claims in a manner inconsistent with some of the other examples in the specifications. The Court concludes that there is no basis in the claim language for importing such a limitation.

Based on the foregoing, the Court concludes that "ANI" and "calling number identification data" are synonymous in the claims at issue in the Katz patents and mean: a signal that identifies the calling number, i.e. the number from which a call originated.

9. In-band or Out-of-band Signaling

[38] The defendants have requested that the Court determine whether the patents require the signals indicating the called and calling number as just discussed to be transmitted "in-band," or along a voice channel in the form of analog signals, and not "out-of-band" via an Integrated Services Digital Network (ISDN) connection. The plaintiffs contend that the patents are silent on whether the signals must be transmitted, or in-band or out-of-band, and thus no particular manner of connection or mode of transmission of these signals is required.

The parties presented expert testimony and argument on the difference between in-band and out-of-band signaling. In short, a signal carrying data may be transmitted over a telephone connection that travels in the same channel or line as the voice signal travels; such a data signal is said to be traveling "in-band." Traditional telephone connections are set up in this manner. A signal carrying data may be transmitted over a telephone connection in a channel or line that is separate from the channel or line that the voice signal travels; such a data signal is said to be traveling "out-of-band." An ISDN connection, which provides two voice channels and one data channel in the same connection, is an example of "out-of-band" signaling. A T1 connection provides for 24 channels or lines in the same connection; a data signal may travel in-band with each of the 24 voice channels or out-of-band in one of the channels along with the other 23 voice channels. (*See* Defendants' Demonstrative Exhibit 36).

To support their argument that the patents require in-band signaling, the defendants contend that the limitation in Claim 96 of the '707 patent which reads "means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data" is a means-plus-function limitation, and therefore, the Court must determine the structure disclosed in the

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specification that corresponds to the "means." [FN25] The defendants contend that the only structure disclosed in the specifications is an in-band connection. For support for this argument, the defendants rely heavily on Figure 1 in the '707, '863, and '309 patents. Figure 1 illustrates one hundred calls or lines coming into the Automatic ***621** Call Distributor AC1, fifty lines coming from the ACD to the Interface 20, and fifty lines coming out of the Interface 20. *See also* Column 4, lines 24 through 27 and Column 5, lines 3 through 13 of the '707 patent. The defendants contend that if Katz contemplated that the call data signals would be sent out-of-band, he would have had to show 51 lines going into and coming out of the Interface to allow for the separate data line in an ISDN connection. The defendants contend that Katz's disclosure of in-band signaling in Figure 1 is the structure to which the "means" corresponds. However, Figure 1 is an illustration of how the Katz system may be set up. Even assuming that the defendants' contention regarding the figure is correct, the Court concludes that Figure 1 does not require that the signals be sent in- band; it only illustrates that the signals *may* be sent in-band.

FN25. The defendants also contend that ANI or calling number identification data, and DNIS, or called number identification data signals, even in claims which are not in means-plus-function form, refers to in-band signaling only. However, to support this position, the defendants point to the same claim language and passages of the specification that they rely on to support their means-plus-function argument. Thus, the Court will treat these two issues together.

In addition, the defendants point to Column 4, lines 52 through 58 of the '707 patent, which indicates that the interface for receiving ANI may be a Centrum 9000 or an interface which includes tone decoders. The defendants contend that such interfaces could only receive analog in-band signals, not digital or ISDN signals. However, even assuming that this representation about the capacity of these interfaces is true, the types of interfaces provided in the specifications are exemplary only; they do not indicate that the signals can *only* be sent via one of these interfaces or that the signals can *only* be sent in-band.

In Column 4, lines 52 through 58 of the '707 patent, Katz notes that "the interface 20 incorporates modems, tone decoders, switching mechanisms, DNIS and ANI capability (call data analyzer 20a) along with voice interface capability." It is clear that the tone decoders and the DNIS and ANI capability of the call data analyzer perform the function of providing and receiving signals from the remote terminals and the communication facility. Thus, the Court concludes that the structures that correspond to the "means" are the Interface 20 and the Call Data Analyzer 20a.

The plaintiffs note that Claim 15 of the '150 patent, a process claim, recites the limitation of "receiving said call data signals from said telephonic communication system for a calling remote terminal," which is not written in means-plus-function form. They argue that the language of this claim in no way indicates the type of line on which the call data signals must be received and because it is not a means-plus-function limitation, it is not appropriate to import structure from the specifications. The Court agrees. In the specification of the '150 patent, in Column 4, lines 12-17, Katz discusses the call data referred to in his claims. The only requirement of the call data signals set forth in the specification pertains to the content of the signal: it must convey the called and calling number. There is no requirement in the specifications that the signals be sent in a certain manner or over a certain type of line or connection.

The patents are silent as to whether the call data signals must be transmitted "in-band" or "out-of-band." Thus, the Court concludes that the claims at issue do not require or exclude any particular manner of transmission or type of signaling.

10. "Consumable Participation Key" and "Limits on Use"

[39][40] The parties have presented the terms "consumable participation key" and "limits on use" to the Court for construction. "Consumable participation key" appears in Claim 51 of the '309 patent and reads in context "qualification structure controlled by said record structure for testing caller data signals provided by a respective one of said individual callers to specify a consumable participation key for restricting the extent of access to said system to limit data stored from said respective one of said individual callers on the basis of entitlement." The term also appears in Claim 65 of the '863 patent and ***622** reads in context "qualification structure for testing caller data signals provided by at least one of said individual callers to specify a consumable participation key, said consumable participation key for use during a single

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predetermined period of time for restricting the extent of access to at least a portion of said system by said one of said individual callers on the basis of entitlement."

The term "limit on use" or "limits on use" appears in Claims 33, 44, and 93 of the '707 patent and Claims 79 and 190 of the '863 patent. Claim 33 of the '707 patent recites in part a "qualification structure controlled by said record structure for testing said calling number identification data to specify a basis for entitlement defining a limit on use, for restricting the extent of access to said system for a respective one of said certain of said individual callers.... An analysis control system according to claim 26, wherein said limit on use relates to a dollar amount." The other claims in which "limits on use" appears are substantively the same; Claim 44 of the '707 is representative and reads "providing products carrying participation numbers specifying limits on use to entitle individual callers to access said operations of the interface with said telephonic communication system."

The parties agree that "consumable participation key" should be defined as a number or word that allows a caller access to a service or part of a service a predefined limited number of times and which cannot be refreshed or recharged. While the ordinary meaning of the claim language gives some indication of the meaning of "consumable participation key," the specification makes it clear. In Column 9, lines 31 through 35 of the '707 patent, the specification provides that "[f]or example, a list may be preserved by a use- rate calculator to implement a consumable key operation. That is, a user is qualified to a specific limited number of uses during a defined interval."

The parties disagree, however, on the meaning of "limits on use." The plaintiffs argue that "limit on use" means "a control imposed on the degree or extent to which callers may avail or utilize a service or one or more operations of a service." (Pls.' App. at 74). The plaintiffs contend that a limit on use can be any one of a range of restrictions including "limits based on the total number of permitted accesses, the time of day for permitted accesses, limits on use based on a dollar value, [and] limits on use based on a predetermined period of time." (Pls.' App. 75-76). The defendants argue that this term has the same meaning as consumable participation key in that it is a control on the number of times a caller may enter a format in the Katz system. The defendants agree that a limit on use can be fixed by a set number of uses or a set dollar amount. However, the defendants argue that a limit on use does not perform a metering function in that it does not effect the duration of access to a format; consequently, it cannot disconnect a caller during a format for exceeding a set period of use.

The place to begin is the claim language. Claim 33 of the '707 patent provides for a limit on use that relates to a dollar amount. The plaintiffs argue that this Claim clearly shows that limit on use is not restricted to only the number of calls or accesses into the system. Although this claim does not explicitly recite that the limit on use would be a duration of time linked to the set dollar amount, e.g. $10.00 limit at $2.00 per minute, it does not explicitly recite that the dollar amount could only be linked to a set number of accesses, e.g. $10.00 limit at $2.00 per access.

The defendants argue that the limits on use are used to qualify callers for access to the operations of the interface, which necessarily has to occur before the caller enters into the Katz system. However, claim 44 of the '707 patent provides for a further step of "invalidating on-line said participation numbers after said limits on use specified by said participation numbers are ***623** reached." This claim calls out a step of utilizing the limit on use at a later point in the process after the qualification step.

The specification confirms that "limit on use" should not be restricted to set number of accesses to the Katz system. In Column 12, lines 52-57 of the '707 patent, Katz describes how a calling number may be "checked by the use- rate calculator to determine the number of times it has been used in excess of a predetermined number of calls *or dollar value* to participate in the lottery during a current interval of monitoring." (emphasis added). Similarly, in Column 12, lines 22 through 26 of the '707 patent, Katz describes how a lottery format may use a limit on use and states that "[f]or example, a person might be entitled to play the lottery a limited number of times or *to the extent of a limited dollar value* during a predetermined interval." (emphasis added).

Contrary to the defendants' assertion, the Court concludes that Katz does not equate all limits on use to consumable participation keys. In Column 9, lines 32 through 35 of the '707 patent, the specification provides that "a list may be preserved by a use-rate calculator to implement a consumable key operation. That is, a user is qualified to a specific limited number of uses during a defined interval." The use of the phrase "limited number of uses," which accurately describes a consumable

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participation key, does not indicate that all "limits on use" are consumable participation keys. Thus, it is clear from the claims and specifications that a consumable participation key is only one kind of a limit on use.

There is no indication in the Katz patents of a method of measuring a limit on use based on a dollar value. That is, neither the claims nor the specifications require that the limit on use based on a dollar value be decremented by the number of accesses to the system, ie. $2.00 for each access. The claims and the specifications leave open the possibility that the dollar amount could be decremented by some other method of measurement, such as time spent in the Katz system; ie. $2.00 for 10 minutes, such that the limit on use served a metering function.

The statements made by Katz in the prosecution history cited by the defendants do not require a different construction than what is clear from the plain language of the claims and specifications. During the prosecution history of the '707 patent, certain of Katz's pending claims, including pending claim 47, were rejected by the examiner in an office action as unpatentable over two patents and an article of Turbat. (Ex. 51). In an Amendment dated August 31, 1995, Katz amended pending claim 47 by substituting the phrase "one time use" with "limit on use." Katz also argued against the examiner's rejection of his pending claim 47 in a section entitled "Discussion of the Rejections of Claims 32, 37, 40, 41 and 47 under 35 U.S.C. § 103." In that section, Katz distinguishes the rejected claim 47 on the basis that "[a]pplicant's system, as claimed, is independent of both *time* (Barger and DeBruyn) and *value* (Turbat)." However, this discussion was clearly directed toward the rejection of the claim as originally written, which called for "a basis of entitlement defining a one time use," as evidenced by Katz's statement at the end of the discussion section that "[t]he rejected claims are urged to be distinct for the reasons presented above." Based on this review of the prosecution history, the Court concludes that Katz's statements about a claim that read "one time use" do not limit the claims that were eventually accepted, which read "limit on use."

Based on the foregoing the Court concludes that "consumable participation key" means: a number or word that allows a caller access to a service or part of a service a predefined limited number of times and which cannot be refreshed or recharged. The Court concludes that "limit on use" means: a control that limits a caller's access to a service based on some predetermined method of measuring the ***624** level of use. The term "limit on use" is not restricted to a specific method of measuring use, such as a limited number of accesses into the Katz system.

B. CLAIMS INVOLVING PRODUCTS CARRYING PARTICIPATION NUMBERS

Claims Involving Products Carrying Participation Numbers are Claims 44 and 93 of the '707 patent and Claims 79 and 190 of the '863 patent. The text of these claims is set forth in the Appendix.

In general, these claims involve a method for limiting a caller's entitlement to access the functions of the system by requiring the caller to enter a participation number. These participation numbers are carried on products that are in some way provided to the caller prior to the call. The participation number corresponds to data stored in memory in the system which specifies a limit on a caller's access to the system.

1. "Products Carrying Participation Numbers"

[41] The plaintiffs contend that the term "products carrying participation numbers" is straightforward and its meaning may be taken from the ordinary meaning of the words themselves. The defendants argue that the words "product" and "carrying" indicate that the product on which the participation number is carried must have inherent value apart from the number; thus, the defendants argue, "products" cannot include prepaid calling cards.

The term "products" is not used in the Katz patents as a term of art, as the parties agree. Thus, the Court should give the term its plain, ordinary English meaning. The Court concludes that the plain meaning of "products," which denotes an item produced for use in a commercial setting, does not support the construction given to it by the defendants. The plain meaning of the term "product" in the claim language does not connote something of inherent value apart from the number carried with it.

The specification does not contradict the plain meaning of "products." The only place in the specification that discusses products carrying participation numbers is Column 17, lines 13 through 17 of the '707 patent, which reads "[a] key to participation in the game show may involve the purchase of a particular product. For example, a person desiring to participate may purchase a product which carries a concealed key number. The number serves as a caller's key to participation in the game

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show." This passage in no way suggests that the product must have value independent of the participation number. The defendants also point to Column 9, lines 35 through 38 of the '707 patent, which discusses restricting callers to the purchasers of a medical apparatus. This discussion is given by way of example only and does not indicate that all "products" must have inherent value apart from the participation numbers.

The defendants rely on statements made by Katz during the prosecution of the '707 patent. In the August 31, 1995 Amendment, Katz distinguished the '275 patent to Kamil by stating that "Kamil discloses a telephone system enabling prepayment for telephone calls, wherein special code and credit information is stored in memory in special exchanges and debited as the call progresses" and that Kamil "does not disclose specific limitation recitations including consumable key operation, nor does it disclose providing a product bearing a participation number specifying a limit on use." (Ex. 51). The defendants argue that Katz clearly stated that his invention was distinct from Kamil because Kamil used prepaid tickets which do not have inherent value, and thus, are not "products."

The Court concludes that Katz did not unambiguously state that his invention required products with inherent value apart from the participation number; it is possible, ***625** for example, that Katz's distinction was based on the fact that Kamil's special code connected with the prepayment for telephone calls did not specify a limit on use. Katz did not mention Kamil's use of a prepaid ticket as a method of recording the prepayment in his statements so it is not clear that Katz was using the concept of a prepaid ticket as the basis for his distinction. In addition, these statements were made by Katz in a voluntary amendment, not in an effort to change the examiner's decision on a rejected claim. Thus, the Court concludes that Katz's statements do not indicate a clear disavowal of coverage so as to require that "products" have inherent value apart from the participation numbers. *See York Products*, 99 F.3d at 1575.

Based on the foregoing, the Court concludes that "products carrying participation numbers" means: a physical item sold or exchanged in a commercial setting which carries a number allowing participation in the Katz system.

2. "Accounting data"

[42] The second term from the Claims Involving Products Carrying Participation Numbers that the parties have presented to the Court for construction is "accounting data." This term appears in Claim 44 of the '707 patent, which includes the step of "providing on-going accounting data to said individual callers at intervals during calls from said individual callers."

The plaintiffs argue that "accounting data" should be construed according to its ordinary, common meaning, which is information relating to a reckoning or a computation. (Pls.' App. 83-84). The defendants argue that "accounting data" means callers' scores in the television game show format because that is the only format in the specifications in which Katz discusses accounting data.

The claim language does not support the construction proposed by the defendants. Nothing in Claim 44 indicates that "accounting data" should be limited to only callers' scores in a television game show format. In addition, Claim 45 of the '707, which is dependant on claim 44, provides for the step of "accounting for said limits on use for said participation numbers for said individual callers by incrementing or decrementing on-line said cumulative use for said individual callers to said limits on use." In this claim, the concept of accounting connotes keeping a record of the usage of the Katz system according to set limits on use associated with a caller's participation number; the language of this claim in no way limits the concept of accounting to scores in a game show.

The defendants contend that Column 16, lines 44-53 of the '707 patent is the only place that Katz describes "accounting data." In that passage of the specification, Katz discusses a television game show format and states that:

> The participant data is stored in an assigned cell of the memory 98 (FIG.4) for the caller and as the game proceeds, the processing unit 92 tallies the caller's score. Scores are interrelated between individual processing units to actuate the terminal CT. Thus, individual accounting occurs for each of the calling participants on an on-line basis dependant upon the success of the studio players and their association with the callers. On-going accounting data may be provided at intervals or real time by the recorded voice to each contestant.

However, in Column 17, lines 44 through 48 of the '707 patent, the specifications reads "the table 99 may be a large, shared unit that tabulates each of the key numbers and accounts for their use. If the caller has identified a proper key number, the process proceeds and the key number is accounted, i.e. incremented or

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decremented to the limit of use if any." Contrary to the defendants assertion, Katz discusses accounting in this passage of the specification in a context other than a television game show format. This passage of the specification is consistent with the language ***626** of Claim 45, which adds the step of "accounting for said limits on use for said participation numbers," and indicates that "accounting data" may relate to the limits on use specified in the participation numbers or consumable key numbers, and not only callers' scores in a game show. Further, even if the only example of "accounting data" in the specification were in the television game show context, the Court finds no reason in the claim language to restrict the term to a disclosed embodiment in the specification. *See Johnson Worldwide*, 175 F.3d 985, 989.

The defendants argue that the prosecution history of the '707 patent supports their construction of "accounting data." In a Supplemental Amendment dated December 28, 1994 during the prosecution of the '707 patent, Katz added Claim 53, which eventually became Claim 37 (upon which Claim 44 depends). In his remarks, Katz stated that "[s]upport for the 'accounting' distinction may be found, for example, at page 34, lines 11-21 of the present specification," which corresponds to the passage in the specifications upon which the defendants rely. The Court concludes that this statement by Katz in no way limits the term "accounting data" to only callers' scores during a television game show format, as evidenced by his use of the phrase "for example."

The claim language and the specification makes it clear that a caller's score in a television game show format is accounting data, but it only one example of accounting data, not the term's definition. Based on the foregoing, the Court construes the term "accounting data" in accordance with its ordinary, common meaning to mean: information relating to a computation of data.

3. "Operations of the Interface"

[43] The third term from the Claims Involving Products Carrying Participation Numbers the parties have presented to the Court for construction is "operations of the interface." This term appears in the preamble of Claims 44 and 93 of the '707 patent and Claims 79 and 190 of the '863. The language containing this term varies slightly in the claims, but generally provides for "[a] process for controlling operations of an interface with a telephonic communication system." The term "operations of the interface" as it appears in the preamble is also referred to in the limitations of the claims, such as "to access said operations of the interface."

The defendants argue that "operations of the interface" is synonymous with "format." The plaintiffs contend that the term should be construed as "the set of processes or actions that effectuates interactive connection and that is part of the work performed by the system connected to the telephone network." (Pls.' App. at 68).

The claim language does not support the defendants' limited construction of this term. In the second limitation of Claim 37, upon which Claim 44 depends, the claim includes the step of "receiving said call data signals ... to select a specific operating format from a plurality of operating formats of said operations of the interface." This claim recites both the terms "format" and "operations of the interface." The use of both terms separately in the same claim indicates that they have different meanings. In addition, the claim refers to selecting one of a plurality of operating formats of the operations of the interface, which shows that the operations of the interface includes more than one format. Further, the term "format" is not present in Claims 93 of the '707 patent or Claim 190 of the '863 patent, which indicates that the operations of the interface do not necessarily include a format.

The term "operations of an interface" is not discussed in the specification. The defendants point out that in Column 10, lines 32, 39, and 43, Katz refers interchangeably to "mail order operating format" and "mail order interface." From this portion of the specification, however, the Court cannot conclude that the operations ***627** of the interface can *only* include a format.

The Court concludes that there is no reason in the claim language or specifications to depart from the ordinary, common meaning of "operations of the interface." Based on the foregoing and consistent with the Court's construction of "interface structure," the Court concludes that the term "operations of an interface" means: the processes, activities, or functions of the interactive connection between the processors upon which the Katz system is running, the communication facility, and the callers. The term does not require that the Katz system be running a format, or specifically, one of the seven formats disclosed in the specifications.

4. "Answer Data"

[44] "Answer data" is the fourth term the parties have presented to the Court for construction from the

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Claims Involving Products Carrying Participation Numbers. The term appears in Claims 44 and 96 of the '707 patent and Claims 79 and 190 of the '863 patent. The language of the limitations in which "answer data" appears is almost identical in each patent and reads "receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers for said individual callers and answer data developed by said remote terminals under control of said individual callers."

The parties agree that the clear meaning of "answer data" is responses by callers to vocal questions or prompts. The defendants ask this Court to exclude any response that includes a telephone number, and specifically the telephone number of the party the caller would like to reach, from the definition of "answer data."

The defendants argue that the specifications describe callers providing answers to questions only in the context of one of the Katz formats, and because making a telephone call is not a format, a telephone number cannot be included in the definition of "answer data." *See* Column 7, lines 46 and 59; Column 17, line 8; Column 19, line 17 of the '707 patent. Even taking the defendants characterization of these passages of the specification as true, the Court has already rejected the defendants' narrow definition of the term "format" in the context of these patents. Further, there is nothing in the passages of the specifications cited by the defendants that indicates that answer data could not include any telephone number, including the number the caller is trying to reach.

The Court concludes that there is nothing in the claim language or specification that restricts the ordinary, common meaning of the term "answer data," which denotes data containing answers or responses. The defendants argue that "answer data" cannot encompass all answers to questions because the claims refer to some types of answers with specific terms, such as participation numbers. Although the claims recite different terms to refer to some specific responses received from the callers, the use of these more specific terms does not indicate that the broad term "answer data" cannot encompass these responses as well.

The prosecution history cited by the defendants does not support their construction of "answer data" nor does it limit the ordinary, plain meaning of the term as expressed in the claims. The defendants argue that Katz distinguished his inventions from a patent to Newkirk, which involved a system that enabled callers to make calls at pay telephones using a magnetic stripe on a card. In the prosecution history of the '968 patent in a Supplemental Amendment dated May 4, 1988, Katz stated that:

> The Newkirk et al. patent (4,439,636) is directed to a system for enabling a magnetic stripe card to be used at a pay telephone somewhat independently of the composite telephone system. Although the Newkirk patent discloses digital communication between a remote ***628** terminal and central terminal, the communication essentially involves the magstripe of a credit card. Distinct from applicant's development, Newkirk does not contemplate any operations related to statistical analysis. Specifically, with respect to the claims herein, while the Newkirk patent utilizes a calendar clock and form records for purposes of billing, the system does not store any form of "answer data."

(Ex. 33). The defendants contend that Katz's statements indicate that a telephone number could not be answer data. The Court concludes that Katz's statement that the Newkirk system did not store any form of answer data does not limit the term "answer data" to exclude responses that include telephone numbers. Katz stated that the only communication between a remote terminal and a central terminal was through the magnetic stripe; such a magnetic stripe would not have constituted "answer data" as this Court concludes that term is used in the Katz patents.

Although not addressed by Katz in his statements regarding Newkirk, the defendants argue that the Newkirk patent provided for callers to be "prompted" by a dial tone to enter the telephone number they were trying to reach. Thus, the defendants argue, Newkirk involved callers' responses to prompts and Katz statement that Newkirk did not include answer data indicates that Katz was disclaiming responses involving telephone numbers from the scope of the term. The Court is not persuaded by this argument for two reasons. First, Katz did not mention that Newkirk prompted callers with a dial tone in his discussion of the Newkirk patent; thus, the Court will not limit Katz's claims by a statement that he did *not* make during the prosecution of the patents. Second, the patents make clear that the questions or prompt must be vocal or voice generated. [FN26] Thus, the dial tone used in Newkirk is not a "prompt" or "cue" as used in the Katz patents.

FN26. Claim 44 provides support for the notion that the questions or prompts are vocal in nature. The third limitation in Claim 37, upon which Claim 44 depends,

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> provides for "coupling said remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating instructions to specific ones of said individual callers." The specification also supports the idea that answer data is responses to vocal questions or prompts. *See* Column 7, lines 46 through 53 of the '707 patent.

During the prosecution of the '846 application, Katz distinguished his patent from a patent to DeBruyn. (Ex. 66). In an Amendment dated July 7,1997, Katz stated:

> DeBruyn is silent as to the fourth and fifth steps of claim 31. These steps provide: "cueing callers with selected questions from a batch of questions;" and "receiving answer data ... responsive to the selected questions." DeBruyn prompts callers for simple and fixed input: a phone number and a Lotto number, which can be confirmed and corrected in linear fashion. There is no suggestion or disclosure of selected "questions from a batch of questions." DeBruyn does not contemplate a selection of the same or different questions for different callers, from a batch of questions. DeBruyn, by its silence, can not imply cueing callers with those questions, nor receiving answer data in response to those questions.

It is clear that in these statements, Katz was distinguishing his patent from DeBruyn on the basis that DeBruyn did not select questions from a batch of questions or receive answers to those questions from a batch of questions. These statements clearly do not indicate that answer data cannot include any telephone number, including the number the caller is trying to reach.

Based on the foregoing, the Court concludes the term "answer data" to mean: responses from callers to vocal questions or prompts.

*629 C. CONDITIONAL FORMAT CLAIMS

The Conditional Format Claims include Claim 15 of the '150 patent and Claims 17, 20, 24, and 77 of the '285 patent. In general, the '150 and '285 patents describe a system and a method for interfacing callers with a processing system which can handle multiple callers and run multiple formats. The '285 patent also includes the option of interfacing callers with a live operator who receives prompts from the processing system. Certain of the formats of the processing system may contain conditions which restrict access to their use by callers; these conditions are stored in memory in the processing system in connection with the corresponding format. Call data, including the called number, the calling number, and the equipment signals, is used by the processing system to select the format the caller wishes to access and to restrict access to formats according to any associated conditions.

Claim 15 of the '150 patent and Claim 17, 20, and 24 of the '285 patent are method claims; Claim 77 of the '285 patent is an apparatus claim. The method claims are very similar and all contain at least four basic steps, including receiving call data signals, selecting a format under control of the call data signals, testing the selected format in relation to the call data signals, and conditionally interfacing said selected format with the calling terminal. The text of these claims is set forth in the Appendix.

The parties' arguments regarding the proper construction of the testing step and the sequence in which the four basic steps in the method claims must be performed are intertwined. The plaintiffs argue that the "testing the selected format step" includes the test referred to in the specification as the "validity bit check," which tests the ANI of the caller against a negative list of "bad" ANIs stored in memory. Under this construction, because the validity bit check may be performed before the selecting step, the testing step could be performed before the format is chosen in the selecting step. The defendants argue that the validity bit check is not encompassed by the testing step, but rather is separately called out in Claim 24 of the '285 patent; thus, as is clear from the claim language, the steps must be performed in the sequence in which they are listed in the claims. The proper construction of the testing step will be addressed first.

1. "Testing the Selected Format"

[45] The first term the parties presented to the Court for construction from the Conditional Format Claims is "testing the selected format." This term appears in all four of the method claims, and reads in context "testing the selected format in relation to said call data signals." Although the claim language is unclear as to whether the test is performed *on* the format or *for* the format, the parties agree that "testing the selected format" means the step of performing a test based on conditions associated with a format before a caller is allowed to interact with a format.

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The disagreement surrounds the scope of the testing step. In addition to the argument over whether the validity bit check is encompassed by the testing step, the parties disagree over whether the test must include the use of a control word or control data and whether the test that is performed must be specific to each format or if formats may be conditioned as a group. The defendants contend that the step of "testing" must involve the use of, or "fetching" of, a "control word" to identify the conditions associated with the selected format. The plaintiffs contend that the step of testing does not necessarily include fetching a control word associated with the selected format and that Katz disclosed other types of testing in the specifications that perform this step of the claims. The plaintiffs contend that a test may apply to groups or categories of formats, or to all of the formats. The defendants contend that the testing step cannot ***630** perform the function of excluding a caller from accessing any formats at all but rather, the testing step determines whether conditions specific to the selected format are satisfied.

The claim language of the testing step is helpful, but not conclusive. The language of the claims does not clearly indicate what the step of testing the selected format involves. The Conditional Format Claims recite "testing *the selected* format," which indicates that the test is performed on one particular format that has in some way been selected. The claim language does not indicate whether or not the same test could be given to a group of formats or if all formats could be tested for a single caller at the same time. Claims 11, 12 and 13 of the '150 patent, which like Claim 15 depend on Claim 10, add the steps of "fetching control data addressable with said call data for use in the step of testing," "composing a control word defining conditions for interfacing," and "fetching data to specify time constraint conditions." These claims specifically call out the steps of composing a control word and fetching control data, which suggests, consistent with the concept of claim differentiation, that the concept of control data is not necessarily implicit in the testing step of independent Claim 10. The claim language does not preclude the possibility that testing other than based on a control word could be encompassed in the testing step. Thus, the analysis must proceed to the respective specifications.

The specifications of the patents describe three main types of testing that are performed on calls. The first type of testing is performed using a control word or control data, which is available for each format and imposes any conditions on accessing the format. *See* Column 5, lines 21 though 25 of the '150 patent. Column 6 lines 54 through 57 of the '285 patent provides that "a control word is available for each operating format of the processor P and is utilized to impose the conditions for an interface and the terms of any associated billing." Similarly, in Column 9, lines 3 through 7, the specification provides "each of the operating formats has a control word for defining any access conditions or limitations to accomplish a specific format." Katz explains that the control words are bits in the control register which indicate the presence and content of conditions associated with a format. *See* Column 9, lines 27 through 37 of the '285 patent. For example, Katz describes test conditions based on the time of the call, the calling history of the caller, and the demographics of the caller. *See* Column 9, line 37 through Column 10, line 9 of the '285 patent.

The specification also discusses testing or conditioning calls as a group. For example, the specification provides "the [historical] record might take the form of either a negative or a positive file (for an individual format). In that regard, formats involving 'pay to dial' calls might be conditioned as a group." Column 5, line 64 through Column 6, line 2 of the '150 patent. Katz also describes "decimal equivalent coding" as a way to condition formats as a group. Katz states that all formats of a particular type may be assigned in a "decimal series," such that all lotteries would be assigned a number in a "100" series, e.g., 101, 102, 103, etc. For example, a caller's ANI may be associated with a decimal series which would exclude that caller from participation in any formats in that decimal series. *See* Column 10, lines 27 through 30 of the '285 patent. The specification provides that decimal equivalent coding "enable[s] a substantial number of formats to be designated and coded with respect to various classifications." Column 8, lines 5 through 17 of the '150 patent; Column 10, lines 10 through 30 of the '285 patent.

Katz also discussed what he refers to as the validity bit check. The validity bit check compares the ANI, or calling number, of the caller to a list of ANIs that are stored in memory. If it is a negative list and the caller's ANI appears on the list, ***631** the caller will be denied access to the Katz system regardless of the format. If it is a positive list, the caller's ANI must appear on the stored list in order to access the Katz system regardless of the format. *See* Column 4, line 60 through Column 5, line 5 of the '150 patent. It is also possible that the calling equipment may appear on a stored list which determines a caller's access to any of the formats. *See* Column 5, lines 1 through 14 of '150 patent.

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It appears both side agree that Claim 24 of the '285 patent corresponds to the validity bit check described in the specification. The claim provides for "storing a record of negative file data, said select processing format using said additional call data signals to access said record and obtain data to specify and test for negative file conditions." The defendants say that Claim 24 does not alter the testing step of the independent claim; rather, the defendants argue it is an additional step that occurs before the testing step.

The Court concludes that, based on the claim language and the specifications, the testing step does not encompass testing formats as a group, such as through the decimal equivalent coding or the validity bit check disclosed in the specifications. The clear language of the claim recites testing "*the selected* " format. According to the specification, decimal equivalent coding is performed on a group of formats at one time and does not operate on the format that is selected by the call data signals. Thus, the Court invokes the legal rule that the specification may not expand the clear meaning of the claim language. As well, the specification shows that the validity bit check is based on the ANI or equipment signal of the caller and is not associated with any conditions placed on a selected format. Based on the foregoing, the Court concludes that "testing the selected format" means: the method by which it is determined whether any conditions associated with the format that has been selected by the call data signals are satisfied.

2. The Sequence of Steps in the Method Claims

The parties disagree over the sequence in which the four basic steps in the method claims, i.e., receiving call data signals, selecting a format, testing the selected format, and conditionally interfacing, must be performed. Specifically, the disagreement centers around the sequence of the selecting and testing steps. The defendants contend that there is a presumption that the steps in a method claim must be performed in the order they are listed in the claim particularly where, as here, the claim language indicates that the testing step must follow the selecting step. The plaintiffs contend that in some embodiments of the invention the testing step could be performed before the selecting step, particularly a situation where a group of formats are being tested, such as the validity bit check.

[46][47] Where the plain meaning of the claim language indicates a sequential nature to the claim steps and the specification does not suggest otherwise, the steps must be performed in the order written in the claim. *See Mantech Environmental Corporation v. Hudson Environmental Services, Inc.*, 152 F.3d 1368, 1376 (Fed.Cir.1998). The testing step provides for "testing *the selected* format," which suggests that the format must be selected before this step can occur. While the specification does indicate that the validity bit check and other testing of formats as a group may occur before the selection of the format, the Court has already concluded that the validity bit check and other group testing is not encompassed by the testing step. Given the clear language and the suggested sequence of the steps provided in the claims, the Court concludes that: the testing step must be performed after the selecting step.

There is also some disagreement over the sequence in which the additional steps other than the four basic steps should be performed in the method claims. Claim 11 ***632** calls out the additional step of "fetching control data addressable with said call data for use in the step of testing." Claims 15 calls out the additional step of "fetching data to specify demographic conditions." Thus, the Court concludes that it is clear from this claim language and the passages of the specifications discussed above regarding control words that: the steps of fetching in Claim 11 and Claim 15 must occur before the testing step.

Claim 20 of the '285 patent contains the additional steps of "selectively terminating certain select calls from said remote terminals in favor of said operator attended terminals" [FN27] and "transferring substantially all of said certain select calls from said operator attended terminals back to said multiple port, multiple format data processing system." The defendants argue that these steps must be performed after the four basic steps that appear before them in the claim.

> FN27. Claim 24 of the '285 also contains the step of selectively terminating certain select calls.

Claim 24 of the '285 patent includes the steps, in addition to the four basic steps, of "providing signal-represented call data from said remote terminals including calling numbers as additional call data signals" "storing a record of negative file data, said select processing format using said additional call data signals to access said record and obtain data to specify and test for negative file conditions," and

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"terminating calls from said remote terminals if said calling number matches said data obtained from said negative file data." The defendants argue that the selectively terminating step must be performed after the four basic steps and the providing step, the storing step, and the terminating step must be performed before the four basic steps are performed.

As for the additional steps in Claims 20 and 24 of the '285 patent, the defendants do not point to any passages of the specification that demonstrate that the additional steps in those claims must be performed in any particular order. There is nothing in the claim language that suggests that those steps must be performed before, after, or during the four basic steps called out in the claims. Interpreting the plain claim language, there is no reason why calls could not be transferred to a live operator or transferred back to the system at any time during a call. Similarly, there is no reason shown in the claim language why a call could not be terminated at any time if the calling number matched negative file data. Thus, the Court concludes that: the claims do not require that the additional steps of Claims 20 and 24 be performed in any particular order.

3. "Call Data Signals"

[48] The term "call data signals" which appears in the "testing the selected format" limitations also raises construction issues for the Court. In Claim 15 of the '150 patent and Claim 17 of the '285 patent, the term "call data signals" appears in the preamble and reads "call data signals, as to indicate called and calling numbers." In Claims 20 and 24 of the '285, the term "call data signals" is not limited in the preamble or elsewhere in the claim to called and calling numbers. The parties agree that in those claims, "call data signals" refers to called numbers, calling numbers, and equipment signals. *See* Column 4, lines 53 through 58 and 65 through 68 of the '285 patent.

The parties dispute the meaning of the term "equipment signals." Specifically, the defendants contend that "equipment signals" is limited to the signal disclosed in the specification, which is a signal that indicates whether the caller is using a touch tone telephone or a rotary dial telephone. Column 3 lines 65 through 68 of the '150 provides that "the call data may specifically include digital signals representative of the called number, the calling number (terminal number) and the terminal equipment." Column 4, lines 10 through 28 of the '150 patent provides that call data may be provided by the communication *633 facility for the called number, the calling number, and "equipment, e.g. [*exempli gratia*] 'pulse' or 'tone' terminal." These passages of the specification do not require that the equipment signal only indicate whether the caller is calling from a pulse or tone terminal.

Column 11, lines 28 through 36 of the '285 patent provides that "[t]he bits '29' and '30' comprise a field 83 and may actuate a special form of the selected format. In the disclosed embodiment, the field 83 registers call data, as to indicate that the calling terminal is a 'pulse' (rotary dial) signal unit or a 'tone' (touch) signal unit." Field 83 in Figure 5 is labeled "equip." The plaintiffs argue that by dedicating two bits in memory for the equipment signal, Katz indicated that equipment signals may encompass more than touch tone or rotary, because only one bit would have been required to store that information. In light of the specification and Figure 5, the Court concludes that "equipment signal" is not limited to a signal indicating whether the caller is using a touch tone or rotary phone and means: a signal that provides information about the equipment from which the caller is making a call.

Another dispute the parties raised in connection with the term "call data signals" is which call data signals may be the basis for a test in the testing step. The defendants argue that the only call data signal that can be tested in the testing step is DNIS. The defendants argue that the equipment signal cannot be tested because equipment signals for touch tone or rotary phones did not exist at the time of the Katz patents. Putting aside whether an equipment signal that indicated rotary or touch tone phones existed at the time of the Katz patents, the specification clearly indicates that the equipment signal may be the basis for disqualifying callers from interfacing with a format. *See* Column 5, lines 1 through 4 of the '150 patent. The claims language of the testing step is "testing the selected format in relation to said call data signals." Although Claim 15 of the '150 patent and Claim 17 of the '285 patent do not include equipment signals from the scope of call data signals in the preamble, there is no basis in the claim language or the specifications to conclude that the call data signals in the testing steps in Claim 20 and 24 of the '285 cannot include the equipment signal.

The defendants also argue that ANI cannot be included in the call data signals of the testing step because Katz disclaimed coverage for testing ANI in the prosecution history. The specifications clearly indicate that a caller's ANI may be used to disqualify him from interfacing with a format. *See* Column 4, lines 61 through 68 of the '150 patent. In the June

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23, 1993 Supplemental Preliminary Amendment during the prosecution of the '285 patent, Katz distinguished his invention from a patent to Fisher by stating that "the patent to Fisher does not disclose receiving calls from random or unknown callers at large and limiting access upon testing *imposed conditions specified by call data including DNIS* from unknown callers." (Ex. 50) (emphasis in original). Contrary to the defendants' assertions, the Court concludes that Katz's statement, "call data including DNIS," is not exclusionary or limiting language and does not exclude ANI from the term "call data signals" in the testing step. Thus, the Court concludes that: the call data signals in the testing step may include the calling number or ANI.

4. "Conditionally Interfacing"

[49] The parties also dispute the meaning of the term "conditionally interfacing the selected format." The parties agree that if the testing step is satisfied, that is, the test is performed and the conditions are fulfilled, then the caller is connected to the selected format. The defendants contend that if the conditions associated with the format are not satisfied in the testing step, the caller is not connected to the format. The plaintiffs contend that the ***634** claims are silent as to what happens if the tested conditions are not satisfied.

The term "conditional interfacing" in the context of the Katz patents connotes that the caller will be connected or interfaced with the selected format if any conditions associated with that format are satisfied. The term in itself does not connote what happens to the call if the format conditions are not satisfied, other than the call will not be interfaced with the format.

The specification provides that after the tests have been performed, "[i]f the call is accepted, the process moves to initiate the selected format interface as indicated by the block 40. Conversely, if the call is to be rejected, the process moves to the step indicated by block 32, i.e. reject the call as with a message and release the line." Column 6, lines 34 through 41 of the '150 patent; Column 8, lines 4 through 6 of the '285 patent (identical provision). Figure 2 of the '285 and '150 patents, which are flow diagrams illustrating the operating process of the system, indicate that if the tests are not correlated, i.e. the conditions are not met ("No" at 48), the call flows in the direction of the arrow to 32, and the caller receives a reject message (32) and the line is released (34).

The specifications indicate that one possible result from a call in which the conditions associated with the selected format are not satisfied is that the call will be rejected and the line released. However, there is nothing in the specifications or the claim language that requires a call to follow the disclosed embodiment in Figure 2 and the specifications reciting the embodied result of rejecting the call and releasing the line. Further, the term "conditionally interfacing" does not in itself raise the question as to what happens to the call if the conditions are not satisfied other than that the call it not interfaced with a format, and there is no other language in the claims that otherwise restricts what happens to a call if the conditions of a format are not satisfied. The Court will not import the limitation on the claim language proposed by the defendants from the specification because there is no "hook" in the claim language on which such a limitation can hang. *See Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248, 1252 (Fed.Cir.1998). Thus, the Court concludes that the claims does not require that the call be terminated if the conditions are not satisfied and the call is not interfaced.

Based on the foregoing, the Court construes the term "conditionally interfacing" to mean: connecting a call to the selected format once any conditions associated with that format have been satisfied.

5. "Live Operator Attended Terminals"

[50] The dispute surrounding the term "live operator attended terminals" centers on whether the prompts provided to the live operators must be identical to the vocal prompts in the automated formats. The plaintiffs contend that the prompts need only assist the operator with the call; the defendants contend that the prompts must simulate the automated format completely.

The claim language does not restrict the prompts displayed to live operator attended terminals in any way. The language of most of the claims at issue from the '285 patent calls out "a plurality of live operated attended terminals." Claim 17 of the '285 patent merely refers to "one of a plurality of operator stations with prompting capability."

As well, the specification does not indicate that the prompts to the live operator must mimic the automated formats. In Column 3, lines 20 through 24 of the '285 patent, the specification indicates that the processor provides formats to automate an interface or prompt a live operator at an operator station. In Column 5, lines 25 through 27 of the '285

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patent, the specification provides that the operator station upon receiving a call receives and displays prompting format data for the attending ***635** operator. Similarly, Column 6, lines 10 through 14 of the '285 patent indicates that when a caller is coupled to an operator station, the appropriate format data is transferred to the station for prompting the operator.

The Court concludes that: there is no indication in the claim language or the specification that the prompts displayed at the operating stations must be identical to the vocal prompts used in the automated formats. Thus, the Court concludes that: the Claims at issue are not restricted in that way.

6. "Selecting a Processing Format"

[51] The dispute surrounding this limitation is over which data signals control the selection of the format. As discussed above, in Claim 15 of the '150 patent and Claim 17 of the '285 patent, the limitation which reads "selecting a processing format of said multiple port, multiple format processing system for the calling remote terminal under control of said data signals as the selected format" indicates that the format is selected by the called and calling number, because "said" data signals are listed in the preamble of the claim as the called and calling number. However, in Claims 20 and 24 of the '285 patent, the data signals are not limited in the preamble of the claim; thus call data signals refers to the calling number, the called number, and the equipment signal.

The parties appear to agree that, despite the claim language "data signals," the only call data signal that selects the format is DNIS, or the called number. The specifications support this position. *See* Column 4 lines 30-31 of the '285 patent ("[T]he call unit CU might be reached by any of twenty telephone dialing numbers, each associated with a specific operating format of the processor P. One called number or set of numbers might be associated with an auction format of the processor P."); Column 5, lines 18 through 24 of the '150 patent ("If a positive validity bit ('1') is formed at the junction of the query block 30, a control word is fetched under command of the called number as indicated by the block 36."); Column 7, lines 13 through 19 of the '150 patent ("The control register 70 receives format control words specified by the called number and having a form as illustrated in Fig. 4."). The Court agrees that despite the use of the broad term "call data signals" in the claim language, it is clear in the context of the patent as a whole that the only call signal that could be used to select a format is the called number or DNIS.

7. "Demographic Conditions"

[52] Claim 15 of the '150 patent recites "[a] process according to claim 11 wherein said step of fetching control data includes fetching data to specify demographic conditions." The parties disagree over the construction of the term "demographic conditions." The plaintiffs argue that "demographic conditions" refers to conditions based on the geographic location of the caller. The defendants contend that "demographic conditions" pertain only to the area code of the caller.

It is clear from the specification that the term "demographic conditions" does not have its ordinary and common meaning in the context of the Katz patents, as both parties agree. In the context of discussing various tests or conditions that may be imposed, the specification provides that "[m]oving from the historic considerations, demographic tests may be specified as in relation to the geographic area manifest by the area code of the calling number." Column 6, lines 24 through 27 of the '150 patent. *See also* Column 12, lines 19 through 25 of the '150 patent. Katz lists several examples of "demographic conditions" in Column 7, lines 61 through 68 of the '150 patent. While all of the examples are conditions limiting calls based on a particular area code, one of the examples is a condition that limits calls to ANIs from a particular area code with particular prefix numerals.

***636** The Court concludes that although the specification discusses demographic conditions in terms the area codes of the calling numbers, there is nothing in the specification that indicates that an area code can be the *only* basis for a demographic condition. Indeed, in one of the examples provided in the specification by Katz, the callers' area codes are used in conjunction with the prefix numerals of the calling numbers to indicate the callers' geographic area and limit the calls from a particular area. This convinces the Court that "demographic conditions" are not restricted to conditions based on the callers' area codes only. Thus, the Court construes the term "demographic conditions" to mean: conditions used to limit a call based on the caller's geographic area.

8. "Means for Directly Forwarding"

[53] Claim 77 of the '285 is an apparatus claim and contains a limitation which reads "means for directly forwarding a call coupled to said interface means for forwarding a call from any one of said remote terminals to one of said plurality of live operator

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attended terminals under control of said call data signals when said remote terminals do not have the capability to digitally provide data."

The parties agree that this limitation is subject to means plus function analysis under § 112, ¶ 6. The function performed by the "means" is directly forwarding a call from a remote terminal to a live operator attended terminal. The defendants argue that although there is no structure that is clearly linked in the specifications to the function disclosed in the claims, this Court should identify the switch SW, line capture unit 62, call register 68, and the control unit 66 from Figures 1 and 3 of the '285 patent as the structures that correspond to the means.

Figure 3 illustrates elements of the switch SW in Figure 1. *See* Column 8, lines 32 through 34 of the '285 patent. Column 8, lines 50 through 57 of the '285 patent describes some of the elements of Figure 3 and provides that "[t]he line capture unit 62 also is connected to a control unit 66. Structurally, the control unit 66 may take the form of various computer facilities incorporating memory and logic capability to sequence and control specific functions.... Generally the control unit 66 implements specific formats which may involve coupling a caller either to a live operator station OS1-OSn or to the processor P." Column 12, lines 55 through 59 of the ' 285 patent indicates that "[i]f the call register 68 does not receive a validity '1' bit, the calling number is indicated to be barred with a consequence that the line is released by the control unit 66."

The Court concludes that based on the specifications, the structure that corresponds to the means is generally the switch SW in Figure 1 and specifically the control unit 66 in Figure 3. Based on the their descriptions in the specifications, the Court concludes that the other structures identified by the defendants, the line capture unit 62 and the call register 68, do not perform the function of directly forwarding a call from a remote terminal to a live operator attended terminal recited in the claim.

The defendants argue that because the claim also requires that the forwarding occur "when said remote terminals do not have the capability to digitally provide data," it does not apply in a situation in which a caller with a touch tone telephone fails or chooses not to push a button on the telephone. The Court concludes that in light of the ordinary and common meaning of the term "capability," this claim means that: a caller is switched to a live operator only when the remote terminal from which the caller is calling is not technically capable of digitally providing data.

D. CLAIMS FROM THE '984 PATENT

The parties have presented Claims 4 and 15 of the '984 patent to the Court for ***637** construction. The text of these claims appears in full in the Appendix.

In general, the '984 patent describes a system for use with a telephone network that controls callers' access to interactive voice applications to prevent misuse. The system can restrict callers' access to interactive voice applications by qualifying calls in different modes, such as "800" mode, "900" mode, or area code mode.

1. Claim 4

a. "First Response Unit Means"

[54] The first term presented by the parties to the Court for construction from the '984 patent is "first response unit means." The term in context reads "first response unit means for receiving calls in said '800' call mode." The plaintiffs argue that this term is not subject to means-plus-function analysis, despite the use of the word "means."

The Court concludes that "first response unit means" is not subject to means plus function analysis, despite the presumption to the contrary due to the word "means." The article presented by the plaintiffs, entitled "AT & T 2: Reaches Agreement with Rockwell" and dated August 26, 1986, discusses the use of audio response units in merging computer speech technology with automatic call distribution systems. (Ex. 362). The Court concludes that this article demonstrates that the term "audio response unit" or "ARU" was used by people in the art of computer telephony and would have connoted sufficient structure to those of ordinary skill in the art at the time. *See Greenberg v. Ethicon Endo-Surgery, Inc.*, 91 F.3d 1580, 1583 (Fed.Cir.1996).

The parties also dispute the meaning of the term "800 call mode" which appears in the same limitation. The plaintiffs contend that this term encompasses "800," "888," and other "toll-free" calls. The defendants agree with this construction, but argue that the term encompasses any call in which the charges are reversed and the call is free to the caller, including foreign access calls and "collect" calls.

Column 1, line 66 through Column 2, line 2 of the '984 patent provides that "[t]elephone calls may be

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accommodated without charge using '800' service or calling mode. Generally, the '800' calling mode accommodates free calls by callers in various areas to a particular station incurring the charges." The Court concludes that it is not proper to determine at the construction stage whether "foreign access calls" and the like are specifically encompassed in the term "800 call mode." The Court agrees with the parties that the proper construction of "800 call mode" is: a toll-free call, ie. a call in which the caller is not charged for the call, such as an "800" or "888" call and the like.

b. "Qualification Means"

[55] The term "qualification means" appears in context as "qualification means for qualifying said calls in said '800' call mode received by said first response unit to provide qualified calls." The parties agree that this term is subject to means-plus-function analysis under § 112, ¶ 6.

Column 4 lines 9 through 14 of the '984 patent provide that "with overall supervision by the control unit 28, the audio response units, 18, 20, and 22 answer and preliminarily qualify callers from the terminals T1-TN for connection through the coupler 24 to the interface processor 26." Column 4, lines 47 through 50 provide that " '[t]he audio response unit 18 is coupled to a free-call memory 32.' Generally, the unit 18 in cooperation with the memory 32 operates with the control unit 28 to qualify acceptable calls in the '800' mode."

The Court concludes that "qualification means" is subject to means-plus- function analysis. The Court concludes that the structures which correspond to the means and perform the function of qualifying said calls in '800' call mode are the audio response unit 18, control unit 28, and the free-call memory 32 in Figure 1 and the ***638** required software to perform the function of qualifying callers.

c. "Second Response Unit Means for Receiving Calls in a Second Call Mode"

[56] The third limitation in Claim 1 of the '984 patent, upon which Claim 4 depends, provides for a "second response unit means for receiving calls in a second call mode." The parties dispute the meaning of the term "second call mode." The plaintiffs contend that the second call mode could encompass anything other than the 800 call mode, which is called out in the first limitation of the claim. The defendants contend that the second call mode must encompass a 900 call mode because a 900 call mode is called out in the preamble to the claim.

The preamble of Claim 4, which appears Claim 1, reads in part "[a] telephone call processing system for receiving calls from a multitude of terminals in different call modes including an '800' call mode and a '900' call mode." The central dispute is whether the recitation of " '900' call mode" in the preamble is a limitation on the claim such that the second call mode called out in the third limitation must be a 900 call mode.

[57] In determining whether the preamble is an additional limitation to the claim, a court must divine the function that the words of the preamble serve. If the claim preamble recites structural limitations of the invention, a court should consider the preamble a limitation on the claim. *See* Rowe v. Dror, 112 F.3d 473, 478 (Fed.Cir.1997). If the claim preamble recites a purpose or intended use for the invention in the preamble and the claim body recites a structurally complete invention, the preamble is not a claim limitation. *Id.* The patent as a whole should be reviewed to determine whether the preamble is structural or a mere statement of the purpose or use of the invention. *Id.*

The preamble of Claim 1 of the '984' patent calls out a system "for receiving calls from a multitude of terminals in different call modes including an '800' call mode and a '900' call mode." This quoted language does not invoke or refer to any structure of the invention. Similarly, the second response unit limitation recites that the second response unit receives calls in a second call mode. This language describes no structure as well. Thus, the Court concludes that the plain language of the Claim 1 indicates that the term "900 call mode" describes a function of managing the calls or a use of the invention, rather than a structural component of the system.

The specification is consistent with the claim language. Column 1, lines 54 through 66 of the '984 patent provides that

> [t]he '900' calling mode is useful for implementing games and contest with telephone interface systems; however, certain problems are encountered. Specifically, certain telephone terminals, e.g. pay phones, do not accommodate '900' service. Also, with respect to certain forms of games and contests, it is important to offer members of the public an alternative 'free' method of participation. In general, the system of the present invention may be employed to implement '900' calling modes while accommodating 'free'

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participation with reasonable control.

This passage indicates that the invention may be used with a 900 call mode as a method of solving the problems discussed in the specification. Column 2, lines 3 through 17 discusses the problems with using traditional area code numbers with interface systems, including the possibility that an overwhelming number of people will respond. This passage indicates that another use of the invention is addressing problems with area code calls. Thus, the Court concludes that using a 900 call mode is only one of the uses of the invention.

Based on the claim language and the specification, the Court concludes that " '900' call mode" as used in the preamble of Claim 1 is more descriptive of an intended use of the invention than of its structure, ***639** and thus, should not be construed as an additional limitation on the claim. Therefore, the Court will not construe the term "second call mode" to require the use of a "900 call mode" on this basis.

The defendants also argue that the prosecution history of the '984 patent requires that the second call mode be defined as the 900 call mode. In an Office Action dated March 21, 1991, the examiner rejected certain of Katz's claims as unpatentable over Fodale, including Claim 1. (Ex. 32). In the June 20, 1991 Amendment, Katz amended Claim 1 to specifically call out an 800 call mode and a 900 call mode in the preamble, just as the language appears in the claim as it was issued. The defendants contend that Katz included a "900 call mode" in Claim 1 in the June 20, 1991 Amendment to traverse the examiner's rejection of that claim, and thus, the term "second call mode" in the claim should be limited to the 900 call mode called out in the preamble of the claim.

The Court's careful independent review of the prosecution history, including the basis for the examiner's initial rejection of Claim 1, the amendments made by Katz, and the discussion in the amendment by Katz of the rejection of his claim as unpatentable over Fodale, reveals that the prosecution history cited by the defendants does not support their argument that "second call mode" should be limited to "900 call mode." The defendants point to no affirmative statement by Katz in his amendment that the term "second call mode" was synonymous with 900 call mode nor does the Court find any such statement by Katz. The mere addition of the term "900 call mode" in the preamble does not indicate that Katz was necessarily limiting the term "second call mode" because there is no statement in the prosecution history relating those two terms to each other. Katz did not in his June 20, 1991 submission amend in any way the use of the term "second call mode" in Claim 1, which left that limitation without reference to the term "900 call mode."

Further, in the same June 20, 1991 Amendment, Katz amended Claim 2 to specifically call out a system wherein the second response unit receives calls in 900 call mode. It may be plausibly inferred that Katz added the phrase "900 call mode" in the preamble of Claim 1 to support his amended Claim 2, rather than to specifically overcome the examiner's objection based on Fodale. Thus, the prosecution history is at best ambiguous as to why Katz added the term "900 call mode" in the preamble of Claim 1. Because Katz did not clearly disclose his intention to do so, the Court will not limit the plain meaning of the claim language based on this ambiguous prosecution history.

Based on the foregoing, the Court concludes that "second call mode" means: a call mode, such as a 900 call mode or an area code mode, other than 800 call mode. The term does not necessarily mean the 900 call mode.

d. "Means for Processing Calls in an Interface Format"

[58] The parties agree that this limitation of Claim 4 of the '984 patent is subject to § 112, ¶ 6. The function performed by the means is processing calls in an interface format. The plaintiffs identify the interface processor 26 as the corresponding structure. The defendants contend that the structures that correspond to the means are the processor 26, random number generator 40, question memory 38, caller record 44, coincidence detector 42 and gate 46 of Figure 1, plus the associated software in Figure 2. The defendants contend that the software must be configured to implement a contest that provides questions to callers, receives answers entered by the callers on the keypad of their telephones, and determines winners of the contest.

The structures identified by the defendants are discussed in Column 8, line 65 through Column 9, line 57 and Column 4, line 57 through Column 5 line 18 as part of the illustrative embodiment of a game format. ***640** In Column 6, lines 63 through 66, the specification provides that "the interface processor 26 receives the calling number and processes the contest format as described in detail below." Thus, the Court concludes that the structure that performs the function of processing calls in an interface format is the interface processor 26 of Figure 1. The Court concludes that the structures that are discussed in the

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context of the game format are not necessarily required to perform the function of processing calls in an interface format, because the game format is only an example of one type of interface format.

2. Claim 15

a. "Memory Means for Storing Caller Cues and Use Indications"

[59] The plaintiffs agree that all of the limitations of Claim 15 are subject to means-plus-function analysis except for the limitation that reads "memory means for storing caller cues and use indications for said caller cues in relation to said callers as identified by said identification signals." Consistent with the Court's conclusion above in footnote 14, the Court concludes that "memory means" would have connoted sufficient structure to one of ordinary skill in the art at the time of the Katz patents such that it is not subject to analysis under § 112, ¶ 6. The Court defines "memory means" as computer hardware that stores information, such as disks, RAM, or tapes.

The defendants also contend that the "caller cues" recited in this limitation must be quiz or lottery questions, as disclosed in the specification. Similar to the defendants' argument that the term "format" should be restricted to the seven disclosed formats, the Court concludes that there is no support in the claim language or specification for limiting the ordinary and common meaning of "cues" to only questions posed in a quiz or lottery. Thus, the Court construes the term "caller cues" to mean: questions or prompts which are given to a caller.

b. "Means for Selecting a Current Caller Cue"

[60] The last limitation in Claim 15 of the '984 patent reads "means for selecting a current caller cue from said memory means for one of said currently active callers for application to said cue means under control of said identification signals for said one of said currently active callers and said use indications in said memory means for said one of said currently active callers."

There is no dispute that the term "means for selecting a current caller cue" is subject to means-plus-function analysis. The function performed by the means is "selecting a current caller cue from said memory means for one of said currently active callers. under control of said identification signals ... and said use indications." The parties' dispute centers on whether the random number generator is one of the structures that correspond to the means. The defendants contend that in addition to the gate 46, the interface processor 26, the coincidence detector 42, and the associated software, the random number generator 38 is essential to perform the function called out in the claim because the specification does not provide for a way to choose questions other than randomly. The plaintiffs contend that the specification shows that the coincidence detector 42 is the structure which decides whether a question is posed to a caller based on use indications associated with that caller.

The specification describes the process of selecting a caller cue in Column 4, lines 59 through Column 5, line 1, which provides that "[g]enerally, the interface processor 26 poses questions to calling contestants.... Questions given to contestants are selected from a memory 38 by a random number generator 40. Essentially, the memory 38 contains an inventory of questions addressable by number provided by the random number generator 40. The ***641** address numbers for the generator 40 are also supplied to a coincidence detector 42 that also receives the address numerals of questions previously presented to a specific caller from a record 44." *See also* Column 8, line 65 through Column 9, line 28.

Thus, based on these passages of the specification, the Court concludes that the "means" in "means for selecting a current caller cue" corresponds to the interface processor 26, the coincidence detector 42, the random number generator 38, and the associated software to perform the function of selecting a current caller cue from memory under control of identification signals and use indications.

III. CONCLUSION

The foregoing constitutes the Court's construction of the terms presented by the parties from the twenty claims designated for the *Markman* hearing.

An appropriate Order follows.

ORDER

AND NOW, this 26th day of August, 1999, upon consideration of the briefs, expert testimony, and oral argument presented by the parties in connection with the *Markman* hearing held from May 24, 1999 through June 4, 1999, in which counsel for all parties participated, and upon consideration of the intrinsic and extrinsic records of the patents-at-issue as indicated in the foregoing Memorandum, it is hereby **ORDERED** that the meaning and scope of the patent claims asserted to be infringed and presented by the

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parties for construction are hereby determined as set forth in the foregoing Memorandum.

APPENDIX
ANALYSIS CONTROL SYSTEM CLAIMS

'309 Patent, Claim 51

46. A control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means, and digital input means in the form of an array of alphabetic numeric buttons for providing data, said control system comprising:

an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication, and including means to provide caller data signals representative of data relating to said individual callers developed by said remote terminals;

voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, connected to receive said caller data signals from said interface structure for updating a file and storing digital caller data relating to said individual callers provided from said digital input means through said interface structure; and

qualification structure controlled by said record structure for testing caller data signals provided by a respective one of said individual callers to specify a consumable participation key for restricting the extent of access to said system to limit data stored from said respective one of said individual callers on the basis of entitlement.

51. A system according to claim 46 wherein said qualification structure restricts the extent of access by said respective one of said individual callers to a single use entitlement.

'707 Patent, Claim 33

26. An analysis control system for sue with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for ***642** providing data and wherein said communication facility has a capability to automatically provide calling number identification data for at least certain of said individual callers, said analysis control system comprising:

an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication;

voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, connected to receive said calling number identification data provided automatically by said communication facility for at least certain of said individual callers, for accessing a file, and storing additional digital data provided by said callers; and

qualification structure controlled by said record structure for testing said calling number identification data to specify a basis for entitlement defining a limit on use, for restricting the extent of access to said system for a respective one of said certain of said individual callers.

33. An analysis control system according to claim 26, wherein said limit on use relates to a dollar amount.

'707 Patent, Claim 104

96. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data wherein said communication facility has a capability to provide call data signals indicative of calling number identification data for at least certain of said individual callers, said analysis control system comprising:

interface structure coupled to said communication facility to interface each of said remote terminals for voice and digital communication, and including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data;

voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, connected to said interface structure for accessing a file and storing data relating to certain select ones of said individual callers in accordance with said calling number identification data;

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qualification structure controlled by said record structure for controlling access to said system by said individual callers; and
means for processing at least certain of said data developed by said terminals and said calling number identification data relating to certain select ones of said individual callers.

103. A system according to claim 96 for use with a communication facility having a capability (DNIS) to provide called number identification data to identify a called number form a plurality of different numbers for calling, and further including means for selecting a specific one of a plurality of formats of said interface structure.

104. A system according to claim 103, wherein said called number identifies a specific one of a plurality of operating formats for interface.

'707 Patent, Claim 117

96. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may ***643** comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data wherein said communication facility has a capability to provide call data signals indicative of calling number identification data for at least certain of said individual callers, said analysis control system comprising:
interface structure coupled to said communication facility to interface each of said remote terminals for voice and digital communication, and including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data;
voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;
record structure, including memory and control means, connected to said interface structure for accessing a file and storing data relating to certain select ones of said individual callers in accordance with said calling number identification data;
qualification structure controlled by said record structure for controlling access to said system by said individual callers; and
means for processing at least certain of said data developed by said terminals and said calling number identification data relating to certain select ones of said individual callers.

115. A system according to claim 96, wherein said individual callers provide other data.

116. A system according to claim 115, wherein said individual callers provide caller credit card number data as said other data.

117. A system according to claim 116, wherein said individual callers provide expiration data for caller credit card number data.

'707 Patent, Claim 192

183. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said communication facility has a capability to provide calling number identification data, said analysis control system comprising:
interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication and including means to receive caller data signals representative of data relating to said individual callers, including caller personal identification data and said calling number identification data provided automatically from said communication facility;
voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers and to prompt said individual callers to enter data;
record testing structure connected to receive and test said caller data signals including said calling number identification data and said caller personal identification data against previously stored calling number identification and caller personal identification data; and
analysis structure for receiving and processing said caller data signals under control of said record testing structure.

191. An analysis control system according to claim 183, wherein said communication facility automatically provides called number identification data (DNIS) to identify a select called number from a plurality of called numbers.

***644** 192. An analysis control system according to claim 191, wherein said select called number (DNIS) identifies a select format from a plurality of distinct

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operating formats.

'863 Patent, Claim 49

27. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein said remote terminals may comprise a conventional telephone instrument including voice communication means, and digital input means in the form of an array of alphabetic numeric buttons for providing data, said analysis control system comprising:

interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication, and including means to provide caller data signals representative of data relating to said individuals callers developed by said remote terminals and including means to receive called number identification signals (DNIS) automatically provided by said communication facility to identify a select one of a plurality of different called numbers associated with a select format of a plurality of different formats;

record structure, including memory and control means, said record structure connected to receive said caller data signals from said interface structure for accessing a file and storing certain of said data developed by said remote terminals relating to certain select ones of said individual callers;

qualification structure coupled to said record structure for qualifying access by said individual callers to said select format based on at least two forms of distinct identification including callers customer number data and at least one other distinct identification data element consisting of personal identification data provided by a respective one of said individual callers; and

switching structure coupled to said interface structure for switching certain select ones of said individual callers at said remote terminals to any one of a plurality of live operators wherein said live operators can enter at least a portion of said caller data relating to said select ones of said individual callers through interface terminals, which is stored in said record structure.

49. An analysis control system according to claim 27, wherein an additional form of distinct identification is provided by said individuals callers on-line and is stored for subsequent use.

'863 Patent, Claim 50

50. A system according to claim 27, wherein said qualification structure further executes a test for unacceptable customer numbers based upon data developed by said remote terminals indicative of said caller customer numbers.

27. (See above).

'863 Patent, Claim 65

65. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means, and digital input means in the form of an array of alphabetic numeric buttons for providing data, said analysis control system comprising:

an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication, and including means to provide caller data signals representative of data relating to said individual callers developed by said remote terminals and including means to automatically receive called number identification signals (DNIS) to identify a select format from a plurality of formats;

voice generator structure coupled through said interface structure for aetuating said remote terminals as to ***645** provide voice operating instructions to said individual callers;

record structure, including memory and control means, said record structure connected to receive said caller data signals from said interface structure for accessing a file and storing digital caller data relating to said individual callers provided from said digital input means through said interface structure; and

qualification structure for testing caller data signals provided by at least one of said individual callers to specify a consumable participation key, said consumable participation key for use during a single predetermined period of time for restricting the extent of access to at least a portion of said system by said one of said individual callers on the basis of entitlement.

'863 Patent, Claim 171

93. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said communication facility has a capability to provide call data signals indicative of calling number identification data and called number

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identification data for at least certain of said individual callers, said analysis control system comprising:

interface structure coupled to said communication facility to interface each of said remote terminals for voice and digital communication, and including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data and said called number identification data (DNIS) to identify one from a plurality of called numbers;

voice generator structure coupled though said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, said record structure connected to said interface structure for accessing a file and storing data relating to certain select ones of said individual callers in accordance with said calling number identification data;

qualification structure controlled by said record structure for controlling access to said system by said individual callers; and

means for processing at least certain of said data developed by said remote terminals relating to certain select ones of said individual callers.

169. An analysis control system according to claim 93, wherein said data relating to certain select ones of said individual callers includes credit card number data.

171. An analysis control system according to claim 169, wherein said credit card number data is tested against unacceptable credit card numbers.

CLAIMS INVOLVING PRODUCTS CARRYING PARTICIPATION NUMBERS

'707 Patent, Claim 44

37. A process for controlling operations of an interface with a telephonic communication system including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said telephonic communication system has a central capability to automatically provide call data signals, indicative of calling number identification data (DNIS) or both, said process including the steps of:

***646** providing products carrying participation numbers specifying limits on use to entitle individual callers to access said operations of the interface with said telephonic communication system;

receiving said call data signals indicative of called number identification data including a called number (DNIS) dialed by a respective one of said individual callers to select a specific operating format from a plurality of operating formats of said operations of the interface;

coupling said remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating instructions to specific ones of said individual callers;

receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers for said individuals callers and answer data developed by said remote terminals under control of said individuals callers;

qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said participation numbers for said individual callers and accordingly providing approval signals for qualified individual callers;

conditionally accessing a memory with said participation numbers and storing data relating to calls from said individual callers;

processing at least certain of said answer data responsive to said approval signals; and

providing on-going accounting data to said individual callers at intervals during calls from said individual callers.

44. A process for controlling operations of an interface with a telephonic communication system according to claim 37, further comprising the step of:

invalidating on-line said participation numbers after said limits on use specified by said participation numbers are reached.

'707 Patent, Claim 93

69. A process for controlling operations of an interface with a telephone communication system, said process including steps of:

providing products carrying participation numbers specifying limits on use to entitle individual callers to access said operations of the interface with said telephone communication system;

coupling remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating

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instructions to specific ones of said individual callers;
receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers for said individual callers and answer data provided from said remote terminals under control of said individual callers;
qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said participation numbers for said individual callers and accordingly providing approval signals for qualified individual callers;
accessing a memory with said participation numbers for said individual callers and storing data relating to calls from said individual callers;
***647** processing at least certain of said answer data responsive to said approval signals.

93. A process for controlling operations of an interface with a telephone communication system according to claim 69, wherein said participation numbers are numbers coded for verification.

'863 Patent, Claim 79

79. A process for controlling operations of an interface with a telephonic communication system including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said telephonic communications system has a capability to automatically provide call data signals indicative of calling number identification data or called number identification data (DNIS) or both, said process including the steps of:
providing products carrying concealed participation numbers specifying limits on use to entitle said individual callers to access said operations of the interface with said telephonic communications system;
receiving said call data signals indicative of called number identification data including a called number (DNIS) dialed by individual callers to select a specific operating format from a plurality of operating formats of said operations of the interface;
coupling remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating instructions to specific ones of said individual callers;
receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers and answer data provided from said remote terminals under control of said individual callers;
qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said participation numbers and accordingly approving qualified individual callers;
conditionally aborting interaction during said operations of the interface with an individual caller at an [sic] remote terminal and coupling said remote terminal to an interface terminal under predetermined conditions for direct personal communication;
accessing a memory with said participation numbers and storing data relating to calls from said individual callers; and
processing at least certain of said answer data responsive to approving said qualified individual callers.

'863 Patent, Claim 190

188. A process for controlling operations of an interface with a telephone communications system, said process including the steps of:
providing products carrying key numbers for participation specifying limits on use to entitle individual callers to access said operations of the interface with said telephone communications system;
coupling remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide voice operating instructions to specific ones of said individual callers;
receiving digital identification data from said individual callers responsive to said voice signals including said key numbers for said individual callers and answer data provided from said ***648** remote terminals under control of said individual callers;
qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said key numbers for said individual callers and accordingly providing approval signals for qualified callers;
accessing a memory with said key numbers for said individual callers and storing data relating to calls

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from said individual callers; and
providing certain of said voice signals to said individual callers to indicate computer generated number data formed during operations of the interface.

189. A process according to claim 188, wherein said computer generated number data is stored in said memory.

190. A process according to claim 189 wherein said computer generated number data is stored in association with said digital identification data.

CONDITIONAL FORMAT CLAIMS

'150 Patent, Claim 15

10. A process for interfacing a telephonic communication system including remote terminals with a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats, at least one of said formats having at least one condition for a calling terminal, and wherein said telephonic communication system provides call data signals, as to indicate called and calling numbers, said process including the steps of:
receiving said call data signals from said telephonic communication system for a calling remote terminal;
selecting a processing format of said multiple port, multiple format processing system for the calling remote terminal under control of said data signals as the selected format;
testing the selected format in relation to said call data signals; and
conditionally interfacing said selected format to a calling terminal under control of said testing of call data signals.

11. A process according to claim 10 further including the step of fetching control data addressable with said call data for use in the step of testing.

15. A process according to claim 11 wherein said step of fetching control data includes fetching data to specify demographic conditions.

'285 Patent, Claim 17

17. A process for interfacing (1) a telephonic communication system including remote terminals either with (2) a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats at least one of said formats at lease one condition for a calling terminal, or (3) one of a plurality of operator stations with prompting capability for a plurality of formats, and wherein said telephonic communications system provides call data signals, as to indicate called and calling numbers, said process including the steps of:
receiving said call data signals from said telephonic communications system for a calling remote terminal indicative of DNIS and ANI automatically provided by said telephonic communications system;
selecting a processing format either for said multiple port, multiple format processing system or one of said plurality of operator stations for the calling remote terminal under control of said data signals as the selected format;
testing the selected format in relation to said call data signals; and
***649** conditionally interfacing said calling terminal to said multiple port, multiple format data processing system for execution of said selected format or to one of said plurality of operator stations under control of said testing of call data signals.

'285 Patent, Claim 20

20. A method for interfacing (1) a telephonic communications system including individual remote calling terminals for individual callers with (2) a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats, at least of one said formats having at least one specified condition for said remote terminals calling to interface said data processing system, and (3) a plurality of live operator attended terminals and wherein said telephonic communication system includes the capability of providing call data signals, said method comprising the steps of:
receiving said call data signals from said telephonic communications system for said remote terminals calling to interface said data processing system including DNIS automatically provided by said telephonic communication system;
selecting for said remote terminals a select processing format from said plurality of formats of said multiple port, multiple format data processing system under control of said call data signals including DNIS provided by said telephonic communications system;
testing said select processing format in relation to

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said call data signals;
conditionally interfacing said selected processing format to said remote terminals selectively terminating certain select calls from said remote terminals in favor of said operator attended terminals; and
transferring substantially all of said certain select calls from said operator attended terminals back to said multiple port, multiple format data processing system.

'285 Patent, Claim 24

19. A method for interfacing (1) a telephonic communications system including individual remote calling terminals for individual callers with (2) a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats, at least of one said formats having at least one imposed condition for said remote terminals calling to interface said data processing system and (3) a plurality of live operator attended terminals and wherein said telephonic communication system includes the capability of providing call data signals, said method comprising the steps of:
receiving said call data signals from said telephonic communications system for said remote terminals calling to interface said data processing system including DNIS automatically provided by said telephonic communication system;
selecting for said remote terminals a select processing format from said plurality of formats of said multiple port, multiple format data processing system under control of said call data signals including DNIS provided by said telephonic communications system;
testing said select processing format in relation to said call data signals;
conditionally interfacing said select processing format to said remote terminals under control of said testing in relation to said call data signals; and
selectively terminating certain select calls from said remote terminals in favor of said operator attended terminals.

*650 22. A method for interfacing a telephonic communications system according to claim 19, further comprising the step of:
providing signal-represented call data from said remote terminals including calling numbers as additional call data signals.

24. a method for interfacing a telephonic communications system according to claim 22, further comprising the steps of:
storing a record of negative file data, said select processing format using said additional call data signals to access said record and obtain data to specify and test for negative file conditions; and
terminating calls from said remote terminals if said calling number matches said data obtained from said negative file data.

'285 Patent, Claim 77

65. An interface control system for use with, (1) a communication facility including remote terminals for individual callers to make calls, wherein said remote terminals may comprise a conventional telephone instrument including voice communication means and some of said remote terminals may further comprise digital input means for providing data, and (2) a multiple port, multiple format processor for concurrently processing data from a substantial number of callers in any of a plurality of formats, said communication facility automatically provides call data signals, as to indicate called data (DNIS), to select a particular format from said plurality of formats, and (3) a plurality of live operator attended terminals with prompting capability, for a plurality of formats, said interface control system comprising:
interface means for providing automated voice messages relating to a specific format to certain of said individual callers, wherein said certain of said individual callers digitally enter data through said digital input means;
means for directly forwarding a call coupled to said interface means for forwarding a call from any one of said remote terminals to one of said plurality of live operator attended terminals under control of said call data signals when said remote terminals do not have the capability to digitally provide data;
means for processing coupled to said live operator attended terminals for processing caller information data entered by an operator at said live operator attended terminal; and
means for storing coupled to said interface means and said processing means for storing certain select data from said caller information data entered by said operator and data entered digitally by said individual callers.

77. An interface control system according to claim 65, wherein at least one of said plurality of formats has at least one imposed condition for said remote terminals calling to interface said interface control system.

'984 PATENT CLAIMS

'984 Patent, Claim 4

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1. A telephone call processing system for receiving calls from a multitude of terminals in different call modes including an "800" call mode and a "900" call mode for processing to an interface format and involving digital signals associated with said terminals as for identification or data, said system comprising:

first response unit means for receiving calls in said "800" call mode;

qualification means for qualifying said calls in said "800" call mode received by said first response unit to provide qualified calls;

second response unit means for receiving calls in a second call mode;

means for processing calls in an interface format; and

***651** means for coupling said qualified calls and said calls in a second mode to said means for processing.

4. A system according to claim 1 wherein said qualification means comprises means for testing said digital signals associated with said terminals originating said calls.

'984 Patent, Claim 15

15. A telephone interface system for individually interfacing callers at a multitude o[f] remote terminals for voice-digital communication through a telephone communication facility, said system comprising:

communication means for establishing telephone communication with currently active callers at certain of said terminals through said telephone communication facility;

means for providing identification signals to said communication means indicative of said currently active callers, said means for providing identification signals comprising means for providing at least a portion of the digits associated with a remote terminal for identification;

memory means for storing caller cues and use indications for said caller cues in relation to said callers as identified by said identification signals;

cue means for receiving said caller cues to provide voice signals through said communications means to prompt responses from said currently active of said callers in the form of digital data signals; and

means for selecting a current caller cue from said memory means for one of said currently active callers for application to said cue means under control of said identification signals for said one of said currently active callers and said use indications in said memory means for said one of said currently active callers.

63 F.Supp.2d 583

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E.O. 12958 Sec. 3.5
NSC Memo, 11/24/98
By kbm NARA, Date 12/29/98

Only the Westlaw citation is currently available.

This case was not selected for publication in the Federal Reporter.

NOTE: Pursuant to Fed.Cir.R. 47.6, this order is not citable as precedent. It is public record.

Please use FIND to look at the applicable circuit court rule before citing this opinion. Federal Circuit Rule 47.6. (FIND CTAF Rule 47.6.)

United States Court of Appeals, Federal Circuit.

MARLOW INDUSTRIES, INC., Plaintiff-Appellant,
v.
IGLOO PRODUCTS CORP., Defendant-Appellee.

No. 02-1386.

May 23, 2003.

Before LOURIE, LINN, and PROST, Circuit Judges.

PROST, Circuit Judge.

*1 Marlow Industries, Inc. ("Marlow") appeals from the decision of the United States District Court for the Northern District of Texas granting summary judgment to Igloo Products Corp. and holding Marlow's United States Patent No. 4,726,193 ("the '193 patent"), as amended by Reexamination Certificate B1 4,726,193 ("the first reexamination") and Reexamination Certificate U.S. 4,726,193 C2 ("the final reexamination") unenforceable due to Marlow's inequitable conduct before the United States Patent and Trademark Office ("PTO"). *Marlow Indus., Inc. v. Igloo Prods. Corp.*, No. 396-CV-2688-P, 2002 WL 485698 (N.D.Tex. Mar. 28, 2002). Because the district court did not commit error in granting Igloo's motion for summary judgment, we *affirm* the judgment.

I

The '193 patent covers picnic boxes. Independent claim 1 reads in pertinent part "[a] refrigerator/food warmer picnic box apparatus or the like comprising ... means ... for *selectively heating and cooling* and circulating the air in the food compartment picnic box ...." (emphasis added). Marlow filed an infringement action against Igloo in September 1996 and cross-moved for partial summary judgment on September 29, 1997, claiming that, as a matter of law, several of the contested picnic boxes infringed the patent.

In an opinion dated April 3, 1998, the district court concluded, "it is obvious that the plain meaning of Claim 1 requires that the picnic box be capable of both 'heating and cooling.' " Both parties moved the court to reconsider its April 3 order. On September 1, 1998, the district court entered an order denying Marlow's motion for reconsideration, but granting Igloo's motion in part by vacating its prior ruling that some of the accused picnic boxes literally infringed the '193 patent, concluding rather that none of the accused products literally infringed the patent. The court left open several issues regarding infringement under the doctrine of equivalents.

In June 1998, Igloo requested the PTO to reexamine the '193 patent to consider prior art that was not previously considered. Marlow subsequently moved to stay further action in the district court until completion of the reexamination proceedings. Igloo's request for the final reexamination brought to the examiner's attention the pending infringement litigation in the district court between Marlow and Igloo, and included a copy of Marlow's brief in support of its September 29, 1997, motion for partial summary judgment. During the reexamination, Marlow attempted to amend the patent by adding claims 4 and 5. These claims included language that covers a picnic box, which "cools or heats" (independent claim 4) and which "only cools" (claim 5, depending from claim 4). The examiner rejected these claims pursuant to 35 U.S.C. § 305, which prohibits expanding the scope of the claimed invention during a reexamination.

Marlow then attempted for a second time to amend the patent by adding claims 6 and 7. These claims, both depending from claim 1, included language covering a picnic box, which "heats and circulates only warm air" (claim 6) and which "cools and only circulates cooled air" (claim 7). The examiner again rejected these claims as an attempt to impermissibly broaden the scope of the original patent. Marlow appealed the examiner's rejection of its claims, including the rejection of its four proposed amendments, to the Board of Patent Appeals and Interferences ("Board"). The Board affirmed the examiner's rejection of proposed claims 5-7. However, the Board reversed the examiner's rejection

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of claim 4 on the basis that it, like preexisting claim 1, includes the "selectively heating and cooling" language and, thus, cannot be construed as enlarging the scope of the claimed invention.

*2 In August 2001, Igloo moved for summary judgment in the district court, in which the infringement action was pending, alleging that Marlow had committed inequitable conduct by failing to disclose to the examiner during the final reexamination of the '193 patent the court's prior claim construction of that patent. The district court determined that Marlow had failed during the reexamination to provide the examiner with the court's April 3 and September 1, 1998 orders, that these orders were material to the reexamination proceeding, and that Marlow knew or should have known that a patent examiner would have found such information material. The district court also found that Marlow failed to submit to the examiner its motion for reconsideration of the court's April 3 order, but the court did not analyze Marlow's inequitable conduct with regard to its failure to submit this document. Based upon these findings, the court concluded that Marlow engaged in inequitable conduct before the PTO. The district court therefore granted Igloo's motion for summary judgment and declared all claims of the '193 patent unenforceable.

Marlow filed a timely appeal and we have jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

II

We review the district court's grant of summary judgment *de novo,* with all justifiable factual inferences being drawn in favor of the party opposing the motion. *See Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255 (1986). Summary judgment is appropriate where there is no genuine issue of material fact and the moving party is entitled to judgment as a matter of law. *See* Fed.R.Civ.P. 56(c). Under *Anderson,* whether a given factual dispute requires submission to a jury must be guided by the substantive evidentiary standards that apply to the case. 477 U.S. at 255. It is the substantive law's identification of which facts are critical and which facts are irrelevant that governs whether a genuine issue of material fact exists. *Id.* at 247-48.

It is well settled that patent applicants are required to prosecute patent applications "with candor, good faith, and honesty." *Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1178, 33 USPQ2d 1823, 1826 (Fed.Cir.1995). This duty likewise applies to reexamination proceedings. 37 C.F.R. § 1.555 (2002). A breach of this duty can take several forms, including the failure to disclose material information. *Molins*, 48 F.3d at 1178, 33 USPQ2d at 1826. Further, a breach of this duty, when coupled with an intent to deceive or mislead the PTO, constitutes inequitable conduct, which, when proven, renders the patent unenforceable. *Id.* at 1178, 33 USPQ2d at 1827.

To establish Marlow's inequitable conduct, Igloo must show by "clear and convincing evidence" that Marlow failed to disclose material information with intent to deceive the PTO. *Kingsdown Med Consultants, Ltd v Hollister, Inc.*, 863 F.2d 867, 872, 9 USPQ2d 1384, 1389 (Fed.Cir.1988); *FMC Corp. v Manitowoc Co.*, 835 F.2d 1411, 1415, 5 USPQ2d 1112, 1115 (Fed.Cir.1987). Once the materiality of the information and Marlow's intent to mislead have been established, the district court must "weigh them to determine whether the equities warrant a conclusion that inequitable conduct occurred." *Molins*, 48 F.3d at 1178, 33 USPQ2d at 1827. Moreover, when balanced against high materiality, the showing of intent can be proportionally less. *Brasseler, U.S.A. I. L.P. v. Stryker Sales Corp.*, 267 F.3d 1370, 1381, 60 USPQ2d 1482, 1488 (Fed.Cir.2001).

*3 On appeal, Marlow maintains that the district court erred in granting summary judgment to Igloo because it raised genuine issues of material fact. According to Marlow, the district court impermissibly weighed the evidence regarding its failure to disclose information to the PTO, the materiality of the allegedly withheld information, and Marlow's intent to deceive the PTO. Igloo counters that Marlow has no additional evidence to offer that would warrant changing the district court's determination or that would otherwise merit further proceedings. After drawing all justifiable inferences in favor of Marlow, we conclude that there are no genuine issues of material fact with regard to Marlow's inequitable conduct and Igloo is entitled to judgment as a matter of law.

A

Marlow first argues that a genuine issue of material fact exists with regard to whether it withheld any information relating to the district court action from the PTO during the final reexamination. In this regard, Marlow notes that it advised the examiner that the '193 patent was the subject of an infringement action pending before the district court, the examiner was provided with copies of the particular documents relating to those proceedings

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which Igloo believed relevant to the final reexamination, and the entire record was made available to the examiner by Marlow's and Igloo's disclosures.

Igloo maintains that Marlow never once apprised the examiner of the substance of the district court's claim construction of the '193 patent or even of the fact that the court had construed the patent. Igloo specifically contends that the district court correctly found that Marlow failed to submit the three disputed documents to the examiner.

The district court did not err in concluding that there was no genuine issue of material fact with respect to Marlow's failure to submit copies of the disputed documents to the examiner during the final reexamination. In its responses to Igloo's Requests for Admission Nos. 92-94, Marlow admitted that at the time of the issuance of the final reexamination, the file wrapper did not include copies of these documents. We reject Marlow's argument that a genuine issue of material fact exists as to whether it withheld any information relating to the infringement action from the PTO. Informing the examiner of the pending infringement action is not commensurate with bringing to the examiner's attention the district court's prior claim construction of the patent or disclosing the court orders embodying this construction. *See Rohm & Haas Co. v. Crystal Chem. Co.*, 722 F.2d 1556, 1572-73, 220 USPQ 289, 302 (Fed.Cir.1983) (concluding that a presumption that an examiner was able to find, with his expertise and adequate time, the critical data when he was presented with a "mountain of largely irrelevant data" ignores the real world conditions under which examiners work). Moreover, the only document from the infringement litigation submitted to the examiner was Marlow's motion for partial summary judgment filed on September 25, 1997, which was included as an exhibit to Igloo's request for reexamination. This document, however, was filed in the district court more than six months prior to the court's initial construction of the '193 patent and, thus, had no bearing on the scope of the claims at issue during the reexamination proceedings.

B

*4 Marlow next argues that a genuine issue of material fact exists with regard to the materiality of the district court's claim construction orders. "Materiality is not limited to prior art but embraces *any* information that a reasonable examiner would be substantially likely to consider important in deciding whether to allow an application to issue as a patent." *GFI, Inc. v. Franklin Corp.*, 265 F.3d 1268, 1273, 60 USPQ2d 1141, 1143 (Fed.Cir.2001) (emphasis in original); 37 C.F.R. § 1.56(b) (2002).

Marlow contends that in reaching its finding that its previous orders were material to the examiner's final reexamination of the '193 patent, the district court erroneously assumed that: (1) the construction of claim 1, and thus claim 4, applied by the Board was in conflict with the district court's construction of claim 1; and (2) Marlow was attempting during the reexamination to avoid the district court's requirement that to infringe the '193 patent an accused device had to be capable of both heating and cooling. According to Marlow, it argued to the examiner that claim 1 could not require both "simultaneous" heating and cooling because that would be physically impossible, which is not inconsistent with the district court's interpretation of the claim.

Igloo responds that the district court correctly concluded that the disputed documents were material to the final reexamination because: (1) they bore directly on the scope of the claims that Marlow attempted to amend; and (2) Marlow's interpretation of the patent asserted before the examiner was inconsistent with the district court's construction of the patent and Marlow's acquiescence to that construction.

The district court did not err in concluding that there was no genuine issue of material fact with respect to the materiality of the April 3 and September 1, 1998, orders to the final reexamination from the standpoint of a reasonable examiner reviewing Marlow's proposed amendments. Faced with Marlow's attempts to amend claim language in the '193 patent, the examiner had to first construe the scope of the claims, including the specific language covering picnic boxes that are capable of both "heating and cooling," to determine whether the proposed "cools or heats" language would impermissibly enlarge the scope of the patent. *See* 35 U.S.C. § 305(a) (2002). In addition, the district court's two previous orders construing the '193 patent and concluding that picnic boxes that only cooled did not infringe the patent were binding on the examiner under the doctrine of issue preclusion. *See In re Freeman*, 30 F.3d 1459, 1466-69, 31 USPQ2d 1444, 1448-51 (Fed.Cir.1994) (concluding that the Board was bound by the district court's prior interpretation of the reissue claims under the doctrine of issue preclusion). Thus, a reasonable examiner would have been substantially likely to consider these two orders important in deciding whether to allow the amendments to issue.

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*5 Moreover, contrary to Marlow's assertion, whether or not the Board, applying the same construction of claim 1 as the district court, found claim 4 equivalent in scope to claim 1 is irrelevant to the materiality inquiry. This court has articulated the materiality criterion as follows:

> [T]he standard to be applied in determining whether a reference is "material" is not whether the particular examiner of the application at issue considered the reference to be important; rather, it is that of a "reasonable examiner." Nor is a reference immaterial simply because the claims are eventually deemed by an examiner to be patentable thereover.

Molins, 48 F.3d at 1179, 33 USPQ2d at 1828 (citation omitted); *Perseptive Biosystems, Inc. v. Pharmacia Biotech, Inc.*, 225 F.3d 1315, 1322, 56 USPQ2d 1001, 1006 (Fed.Cir.2000) (stating that a patent may be valid and yet be rendered unenforceable due to inequitable conduct). Thus, that the Board's interpretation of the '193 patent may have been consistent with the district court's previous construction does not eviscerate the materiality of the previous orders from the viewpoint of a reasonable examiner in the first instance. Here, a reasonable examiner reviewing Marlow's proposed amendments would have considered the district court's prior construction of that patent important.

C

Lastly, Marlow argues that a genuine issue of material fact exists with regard to Marlow's intent to deceive the PTO. Intent to mislead does not require direct evidence, and is typically inferred from the facts. *GFI*, 265 F.3d at 1274, 60 USPQ2d at 1144. Intent may be inferred when a patent applicant knew, or should have known, that withheld information could be material to the PTO's consideration of the patent application. *Critikon, Inc. v. Becton Dickinson Vascular Access, Inc.*, 120 F.3d 1253, 1256-57, 43 USPQ2d 1666, 1668-69 (Fed.Cir.1997); *Brasseler*, 267 F.3d at 1375-76, 60 USPQ2d at 1484; *Merck & Co. v. Danbury Pharmacal, Inc.*, 873 F .2d 1418, 1422, 10 USPQ2d 1682, 1686 (Fed.Cir.1989) (stating that intent is most often proven by a showing of acts the natural consequences of which are presumably intended by the actor).

Marlow argues that a factual dispute exists with regard to its alleged intent to deceive the PTO. According to Marlow, the district court found intent by incorrectly assuming that claim 4 is broader than claim 1 and by disregarding the affidavit of Marlow's attorney denying an intent to deceive.

Igloo argues that the district court correctly concluded that Marlow acted with intent to deceive the PTO. According to Igloo, Marlow knew, or should have known that the examiner would have considered the district court's claim construction of the '193 patent (specifically its holding that cool only or heat only devices cannot infringe the '193 patent) material to Marlow's attempts to add claims directed to cool only or heat only devices. Igloo further contends that the affidavit of Marlow's counsel does not create a genuine issue of fact as to Marlow's intent because it consists of mere denials of an intent to deceive.

*6 The district court did not err in concluding that there was no genuine issue of material fact with respect to Marlow's intent to deceive the PTO by failing to submit the district court's prior orders construing the claims of the '193 patent when it proposed amended language during the final reexamination. The same attorney represented Marlow before the district court in this case and before the PTO during the final reexamination proceedings. *See Critikon*, 120 F.3d at 1257, 43 USPQ2d at 1669 (noting that the patent counsel who were handling the reissue proceedings were keenly aware of the ongoing district court litigation and the issues involved prior to the resolution of the reissue proceedings). Yet, despite the district court's prior holding that a picnic box had to both heat and cool to infringe the '193 patent, Marlow proposed claims using the disjunctive language of "cools or heats." *See In re Freeman*, 30 F.3d at 1465, 31 USPQ2d at 1448 (stating that "given the interpretation of the district court during the infringement litigation, it is clear that the amendments to the independent claims during reexamination attempt[ed] an end run around the [district court's] interpretation"). Under these circumstances and in light of the binding nature of the district court's prior claim construction, Marlow's failure to submit the April 3 and September 1, 1998, orders leads to a finding that Marlow intended to deceive the PTO. As the district court recognized when considering Igloo's inequitable conduct motion, Marlow should have known that a patent examiner would have found the two prior court orders considering the construction of the '193 patent material to the reexamination. Indeed, during the pendency of the reexamination, Igloo's counsel twice reminded Marlow by letter of its duty to disclose the district court's claim construction to the examiner. The only evidence Marlow offers to negate a finding of an intent to deceive is an affidavit from its counsel denying such deceitful intent. However, a mere denial of an intent to deceive is not sufficient where a

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patentee faces a high level of materiality and proof that it knows or should have known of that materiality. *Critikon*, 120 F.3d at 1257, 43 USPQ2d at 1669 (citing *FMC Corp .*, 835 F.2d at 1415, 5 USPQ2d at 1116).

CONCLUSION

In sum, we conclude that viewing the evidence in the light most favorable to Marlow, there is no genuine issue of material fact as to the materiality of the district court's April 3 and September 1, 1998, orders to the final reexamination of the '193 patent and Marlow's intent to deceive the PTO. Furthermore, the district court did not abuse its discretion in holding the '193 patent unenforceable. Accordingly, we affirm the district court's order granting summary judgment of invalidity to Igloo.

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